ASSESSMENT OF THE STATUS OF THE FISH COMMUNITY OF ONONDAGA LAKE IN 2001, ONONDAGA LAKE 2001 FISH MONITORING PROGRAM

Prepared for

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EXECUTIVE SUMMARY

As part of an Amended Consent Judgment between Onondaga County and the New York State Department of Environmental Conservation (NYSDEC), the Onondaga County Department of Water Environment Protection (OCDWEP) has been tasked with conducting an Ambient Monitoring Program (AMP) on Onondaga Lake and several of its tributaries. Part of this program involves assessing the fish community of the lake over time as mandated improvement projects are completed at the Metropolitan Syracuse Wastewater Treatment Plant and the Combined Sewer Overflow network located on some Onondaga Lake tributaries. The approved fisheries assessment program portion of the AMP dictates that sampling will be conducted every two years from 2000 to 2012. The year 2001 Onondaga Lake fish sampling program was a non-mandatory voluntary effort by OCDWEP. The 2001 effort focused on assessing the relative abundance and species composition of the lake's fish community, evaluating propagation success, establishing baseline conditions of the fish community, and experimenting with differing sampling techniques in order to identify the most efficient and cost effective way of sampling some parts of the fish community.

Sampling of the Onondaga Lake fish community was accomplished by targeting different life stages and habitats of fish with collection gear suited specifically for sampling specific features of the community of interest. As a result, individual programs were conducted for sampling pelagic (open water) larval fish, littoral (shallow water or shoreline oriented) larval fish, littoral juvenile fish, littoral adult fish, and littoral nesting fish. Sampling of the adult pelagic community was not conducted in 2001 as it had been in 2000.

The littoral habitat of the lake was divided into five strata based on a combination of substrate type and wave energy, both of which influence aquatic macrophyte abundance and, in turn, habitat quality. These strata form the basis of the stratified sampling program used for littoral adults, juveniles and littoral larvae. These five strata are:

Stratum 1. Oncolite substrate with low wave energy (NW portion of lake).
Stratum 2. Wastebeds with a mixture of $CaCO_3$ (20%), Ca silicate (10%), MgOH (8%), and other mineral substrates with silt-like texture (mid-lake western shore).
Stratum 3. South end with soft sediments that reflect influences from tributaries and wastewater/stormwater facility outfall.
Stratum 4. Oncolite substrate with high wave energy (SE shoreline)
Stratum 5. Oncolite substrate with medium wave energy (NE portion of lake).

The larval fish community was sampled using three techniques, Miller high-speed trawls (pelagic), larval seines (littoral) and light traps (both pelagic and littoral). Sampling was conducted once a month in May, June and July of 2001. Pelagic larval sampling stations were evenly distributed between the north and south basins of the lake. Littoral larvae seining sites were evenly distributed between the five strata previously described. The inclusion of light traps as a larval fish sampling technique in 2001 was done in an attempt to determine if this type of equipment would be a an efficient and cost effective manner of obtaining comparable larval fish samples.

Juvenile fish were collected approximately every other week in August and September using standard NYSDEC seine sampling protocols. Littoral juvenile seining sites were the same as the littoral larvae sites previously described.

The lake's littoral zone was divided into 24 approximately equal length segments for sampling adults by boat electrofisher and a fish nest survey. Adult fish were sampled in these same 24 segments by boat electrofishing in May, September, and October 2001. Fish nests within each of the 24 segments were counted once in June to assess the distribution and species composition of centrarchid (bass and sunfish) spawning.

The larval fish sampling captured and identified 626 fish comprising 12 species. Common carp was the most abundant species, accounting for 45% of the combined larval catch. Gizzard shad with 23% and *Lepomis* sp. at 11% were the next most frequently collected species. Nine other species each comprised the remaining 21% of the catch contributing less than 10% of the total catch. Diversity of larval fish collected by different sampling gears was highest for pelagic light traps (0.59), followed by littoral seines (0.54), pelagic trawls (0.42), and littoral light traps (0.39). The larval gear species richness values were highest for littoral seines (8 species), pelagic trawls (6 species), littoral light trap (6 species), and pelagic light traps (4 species). The proportional species composition was significantly different (chi-square) when comparing both the pelagic trawl and pelagic light trap (p-value = 0.0008) and the littoral seine and littoral light trap (p-value = 0.0000) catches indicating that light traps generally captured different communities than either the trawls or seines. Low catch rates of larval fish in each of the sample gears deployed in 2001 limited our ability to determine if light traps are an acceptable alternative to the current sampling gears impossible.

The juvenile littoral seine study focused on the post-larval survival of species that successfully reproduced in the lake. The juvenile seine efforts captured 8,163 fish from 18 species. *Lepomis* sp. (consisting of both bluegill and pumpkinseed) was the most abundant taxa representing 68% of the catch, followed by gizzard shad at 19%. The remaining 16 species each individually accounted for less than 5% of the catch. The mean Catch per Unit Effort (CPUE) for August and September combined was 136/haul. All five lake shore strata had similar species composition and the overall diversity index value for the lake was 0.47 (range across strata was 0.21-0.51). The relative weights (a measure of plumpness) for juvenile largemouth bass and smallmouth bass were 114 and 95 respectively, indicating favorable feeding conditions in the lake at the time of sampling. Condition factor values (another measure of plumpness) varied from 2.1 to 3.3 for smallmouth bass by strata, while largemouth bass was relatively consistent at about 2.9, which is also indicative of favorable feeding conditions in the lake.

A total of 1,887 fish nests were observed during the littoral nesting survey, all of which were located in the north basin of the lake. Pumpkinseed was the most common species encountered, representing (89%) of nest observed. Bluegill, largemouth bass, smallmouth bass and nests where no fish was observed contributed the remaining 11%.

The 2001 electrofishing survey collected a total of 2,809 fish comprising 22 species. The species collected were primarily adult warmwater species, with the majority being considered by several authors to be moderately to highly tolerant of pollution, such as nutrient enrichment, turbidity

and shoreline disturbance. Species composition (with 22 species overall) varied little by season. The species diversity was highest in September (0.98), lowest in October (0.78), and the diversity of the total catch was 0.95. The CPUE was highest in May (514/hr.) and lowest in September (164/hr.). Gamefish accounted for 29% of the total CPUE, with the most abundant species being yellow perch and bluegill. Differences between strata were most pronounced in May due to a large catch of gizzard shad. No yearling largemouth bass and few (0.377/hr.) yearling smallmouth bass were captured. This may indicate possible poor survival of the 2000 year-class of largemouth and smallmouth bass. Nine species of fish examined for condition factors, with the exception of smallmouth bass and white sucker had values near the ideal of 3.0. The relative weight value for both smallmouth bass and white sucker was 98. The generally good condition factors and relative weights of most adult fish studied indicates that fish were probably feeding well in Onondaga Lake during the sampling periods. Proportional stock density (PSD) is a numerical descriptor of length-frequency data. Bluegill (75) had the greatest PSD value, followed by smallmouth bass (65), largemouth bass (65), and pumpkinseed (62). These values are typical of a fishery dominated by large, old individuals and are often reflective of an under-fished waterbody.

Based upon the result of the 2000 and 2001 fish sampling programs and input from Technical Advisors and members of the Biological Working Group the OCDWEP fish community monitoring program in Onondaga Lake was changed from an intensive biennial sampling program to a less intensive annual program beginning in the year 2002.

1.0 INTRODUCTION

Monitoring of the fish community in Onondaga Lake is among the requirements of the Amended Consent Judgment (ACJ) signed by Onondaga County in January 1998. Onondaga County is required to "Complement the chemical monitoring program with a biological monitoring effort to assess the densities and species composition of phytoplankton, zooplankton, macrophytes, macrobenthos, and fish" (ACJ Appendix D, IV.4). The ACJ also states that the County should "evaluate the success of walleye, bass and sunfish propagation (quantitative lakewide nest surveys, recruitment estimates, and juvenile community structure) in the lake" (ACJ Appendix D, IV.5). Sampling is to be conducted every two years through the 15 years of the County's Ambient Monitoring Program (AMP).

The objectives of monitoring this element of the aquatic ecosystem are to:

1. Assess relative abundance and species composition of fish.
2. Evaluate success of walleye, bass, and sunfish propagation.
3. Evaluate impacts of control actions on the fish community.

Intensive monitoring of the fish community was conducted in 2000 (IA and EcoLogic 2001). Fish nests, pelagic and littoral larvae, littoral juveniles and pelagic and littoral adults were sampled. However, members of the Onondaga Lake Technical Advisory Committee and others recommended a shift from the intensive biennial program to a less intensive annual program. This recommendation was based on the need to characterize year-to-year variability. During 2001, the Onondaga County Department of Water Environment Protection (OCDWEP) sampled the fish community of Onondaga Lake to meet the following objectives:

- Gather data to characterize the fish community in 2001.
- Evaluate the efficiency of light traps in sampling the larval fish community.

This report presents the results of the year 2001 Onondaga Lake fish monitoring program.

2.0 MATERIALS AND METHODS

This section describes the field sampling programs that comprised the 2001 fisheries sampling program, and the methods used to analyze the data collected. Differences between the 2000 and 2001 field sampling programs are specified.

2.1 FIELD SAMPLING

As discussed in Section 1.0, the fisheries sampling program in 2001 was considered as a model of a reduced annual version of the biennial sampling program that was conducted in 2000. As such, there were modifications to the sampling gear, season, frequency, and sites to some aspects of the sampling program in 2001. The components of the 2000 and 2001 programs are summarized in Table 2.1-1 for comparison. Program modifications are described in more detail in the following sections.

2.1.1 Pelagic Larvae Sampling

Pelagic ichthyoplankton (fish larvae) samples were collected in open water (>10 m) on May 16, June 13, and July 12, 2001 in the north and south basins of Onondaga Lake (Figure 2.1-1). Sampling generally followed the procedures outlined in the NYSDEC Percid Sampling Manual (1994). Larvae were sampled at night with a Miller high-speed trawl using a net mesh size of 500 μm. A depressor was suspended 0.6 m below the trawl for stability. One sample was collected from each of three depths (1, 3, and 5 m) at each location (north or south basin) for a total of six samples collected within Onondaga Lake per sampling date. Trawls were towed on a straight transect at a constant 7 mph for 4 minutes. A factory-calibrated flowmeter was mounted in the center of the mouth opening of a Miller high-speed trawl to estimate volume of water sampled. A calibrated multi-parameter water quality meter was used to measure a profile of dissolved oxygen, conductivity, pH, and redox at 0.5-m depth intervals in each basin.

Trawls were retrieved and contents were emptied into a labeled plastic sample jar and preserved in 10% formalin solution. Samples were subsequently transferred to 70% ethanol.

Larval light traps, similar to the one depicted in Figure 2.1-2, also were deployed in conjunction with the Miller high-speed trawl sampling. The traps were constructed so that larval fish, attracted to the light stick, entered the trap through v-shaped notches on the sides of the trap. The light traps were set at night in water deep enough to allow proper functioning and in the proximity of Miller sampler transects, with which they were paired. The traps were deployed for approximately 4 hours. When the traps were retrieved, the fish were captured in the collection bucket at the base of the traps. The light trap samples were handled and processed the same as the Miller trawl samples.

2.1.2 Littoral Larvae Sampling

Sampling of fish larvae in the littoral zone of the lake occurred during daylight on May 17, June 14, and July 11, 2001. The lake was divided into five shoreline strata based on habitat type (Figure 2.1-3). One site within each stratum was sampled with a 3.1-m long x 1-m deep larval fish seine with 500-μm mesh netting. Prior to sampling, the water temperature, dissolved oxygen, specific conductance and pH were measured at a depth of 1 m with a calibrated water quality meter. The seine was stretched perpendicular to shore in 1 m of water and hauled for a distance of 10 m. After completion of the haul, the bottom lead line was lifted to a horizontal position parallel to the top float line and the seine was taken to shore for processing.

After a seine sweep was completed, the seine was rinsed in a 30-gal tub until all material was removed. The contents of the tub then were filtered through a 500-μm sieve bucket and placed in a pre-labeled sample jar containing 10% formalin . Samples were subsequently transferred to 70% ethanol. Larval fish from each sample were identified to species (or the lowest possible taxon) and enumerated. These samples were picked, sorted, and identified by trained OCDWEP personnel.

Larval light traps were deployed in conjunction with the seining effort. The light traps were set at night on the same dates as the larval seine sampling, in the proximity of a paired seine sampling location and in water deep enough for proper functioning. The construction and operation of the light trap are described in Section 2.1.1. The light traps were deployed for

approximately 4 hours. The light trap samples were handled and processed the same as the seine catches.

2.1.3 Juvenile Fish Sampling

Juvenile fish sampling in Onondaga Lake during 2001 was conducted by trained OCDWEP personnel and generally followed the procedures outlined in the NYSDEC Centrarchid Sampling Manual (1989). Four sampling events were completed: mid-August (9^{th} – 13^{th}), late August (22^{nd} – 23^{rd}), early September (4^{th} – 6^{th}), and late September (21^{st} – 24^{th}). The stratified random sampling design used for littoral larval seining also was used for juvenile fish seining. The lake was divided into five strata based on habitat (Figure 2.1-3), with three sites sampled within each of the five strata, for a total of 15 sampling sites. The samples consisted of a one-quarter-circle (45°) sweep of a 50 ft (15.2m) x 4 ft (1.2 m), ¼-inch (0.64 cm) mesh bag seine dragged in <2 m of water.

During sampling, one brail of the seine was held on shore and the other end was extended perpendicular to shore. Holding the in-shore brail stationary, the lakeward brail was swept to shore. After the single haul was completed at a site, the fish were identified by a fisheries biologist and counted. A minimum of 10 individuals of each species at each site was measured for length. Unknown species were preserved in a 10% formalin solution and identified at a later date. Smaller (<30 mm long) bluegill and pumpkinseed sunfish were nearly indistinguishable from each other; therefore all young-of-year sunfish were lumped (in the field) into the category of "*Lepomis* spp."

2.1.4 Adult Fish Sampling

Fish were sampled by boat electrofishing conducted by trained OCDWEP personnel within the littoral zone of Onondaga Lake. General procedures outlined in the NYSDEC Centrarchid Sampling Manual (1989) were followed. The electrofishing survey was conducted once in the spring (May 9-11) and twice in the fall (September 17-19 and October 22-24). The lake's littoral zone was divided into 24 equal-length segments, or transects (Figure 2.1-4). The electrofishing boat was run parallel to shore along each transect, and the actual electrofishing time to cover

each transect was recorded. The entire shoreline was sampled, as the end of one transect was the beginning of the next. Sampling occurred at night (from ½ hour after sunset to ½ hour before sunrise). The electrofishing unit (Smith-Root Type GPP 9.0) was set at a pulsed DC frequency of 120, 340 volts, and 21 to 25 amps.

Transects were sampled in one of two ways. For odd-numbered transects, all fish species seen were captured and processed, as described below. For even-numbered transects, all fish were netted; however, only the gamefish were retained for processing, while non-game fish were released. The following species were considered gamefish for this purpose.

Largemouth bass	White crappie
Smallmouth bass	Brown bullhead
Walleye	Yellow bullhead
Yellow perch	Channel catfish
Bluegill	All esocids (pike family)
Pumpkinseed	Rock bass
Black crappie	All salmonids (trout)

Fish collected for processing were identified to species, measured for total length (nearest mm) and, for the October samples, weighed (nearest g). For samples in which small to moderate numbers of fish were collected, all fish were measured. For samples in which high numbers of one or more species were collected, subsampling was conducted in the following manner. Thirty randomly selected fish of each species were measured for length and weight (October only), and the remaining fish were identified to species and counted only. All carp and gizzard shad occurring in large schools were visually estimated without actually collecting the fish to minimize catch mortality and to facilitate processing of the catch.

Adult gamefish in good condition also were tagged with a numbered Floy tag. The Floy tags were labeled with information directing anyone recovering a tagged fish to contact the OCDWEP so information on the species, location/date of capture, and size of the fish could be obtained. Scale samples were collected for smallmouth bass, largemouth bass, walleye, rock

bass, yellow perch, white perch, bluegill, pumpkinseed, gizzard shad and black crappie during fall sampling from the first 10 adults of each species collected per transect. The goal was to collect a minimum of 30 samples per species for each of the two fall sampling events. Scale samples were collected from the side of the fish, below the lateral line and under the tip of the pectoral fin.

Littoral Nesting Survey

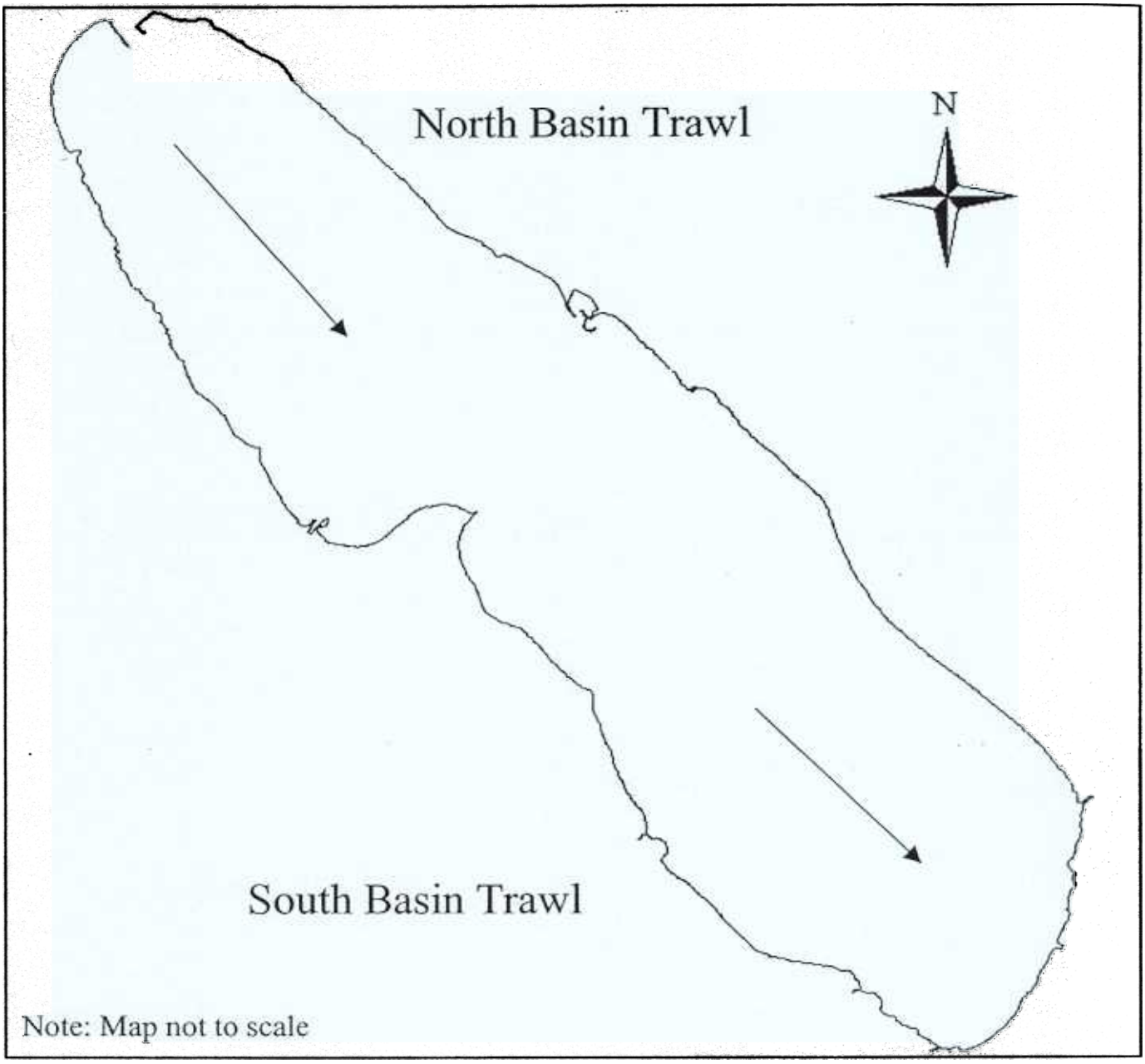
Fish nests were counted along 24 transects distributed around the lake's littoral zone on June 7, 2001. Establishment of transects is described under Section 2.1.4, since the same transects also were used as boat electrofishing stations. Date of the survey was determined based on water temperature (between 60 and 65°F), water clarity (ability to see bottom in 2 m of water), and weather conditions (sunny and calm). Nests in each section were counted by maneuvering a small boat at constant speed, parallel to shore, in a single transect over 1 m of water. One observer wearing polarized sunglasses stood on an elevated platform at the front of the boat, reporting the number of nests observed and, if possible, the species guarding those nests. A second person recorded the observation data, while a third person piloted the boat.

Physical/Chemical Sampling

Conditions at each collection site were recorded prior to sampling. Items recorded included location, weather conditions, personnel, time, date, water clarity (good, moderate, poor), water temperature, dissolved oxygen concentration, conductivity, pH, and redox potential. The water-quality measurements were made at a depth of 1 m for the littoral sampling sites and at 0.5-m intervals from surface to bottom at pelagic sampling locations. Habitat variables were recorded for each sampling location and included substrate (% composition of the three most dominant types, e.g. mud, cobble or oncolites), cover (structural and vegetative), and water depth. These recorded variables varied by gear type: substrate, cover, and depth for seining; cover and depth for electrofishing; and cover and substrate for the nesting survey. Data were recorded on field sampling sheets at the time of sampling and later entered into a database by County personnel.

Table 2.1-1 Comparison of elements of the 2000 and 2001 Onondaga Lake Fisheries Assessment Programs.

SURVEY	GEAR	YEAR	SAMPLING INTERVAL	FREQUENCY	SITES	TOTAL # SAMPLES
Pelagic larvae	Miller trawl	2000	May-July	biweekly (7 surveys)	3 depths (1, 3, 5-m) at 6 transects in 2 basins (N,S)	252
	Miller trawl	2001	May-July	*monthly (3 surveys)*	3 depths (1, 3, 5-m) at *1 transect* in 2 basins (N,S)	18
	Light trap	2001	May-July	*monthly (3 surveys)*	3 depths (1, 3, 5-m) at *1 transect* in 2 basins (N,S)	18
Littoral larvae	10-m seine	2000	May-July	biweekly (7 surveys)	3 reps at each of 3 sites in 5 shoreline strata	315
	10-m seine	2001	May-July	*monthly (3 surveys)*	*1 site* at 5 shoreline strata	15
	Light trap	2001	May-July	*monthly (3 surveys)*	*1 site* at 5 shoreline strata	15
Juvenile seine	50-ft seine	2000	May-September	every 3 weeks (7 surveys)	3 reps at each of 3 sites in 5 shoreline strata	315
	50-ft seine	2001	August-September	*biweekly (4 surveys)*	3 sites at 5 shoreline strata	60
Adult electrofishing	boat shocker	2000	May, September, October	3 monthly surveys	4-6 sites at 5 shoreline strata (total 24 sites)--forage fish not counted at 12 sites	72 (36 for forage species)
	boat shocker	2001	May, September, October	3 monthly surveys	4-6 sites at 5 shoreline strata (total 24 sites)--forage fish not counted at 12 sites	72 (36 for forage species)
Adult gill netting	variable-mesh gill nets	2000	May, September, October	3 monthly surveys	1 net in 2 basins (N,S)	6
	variable-mesh gill nets	2001	*not done*	***not done***	***not done***	0
Littoral fish nesting survey	visual counts	2000	June	1 survey	24 sections	24
	visual counts	2001	June	1 survey	24 sections	24



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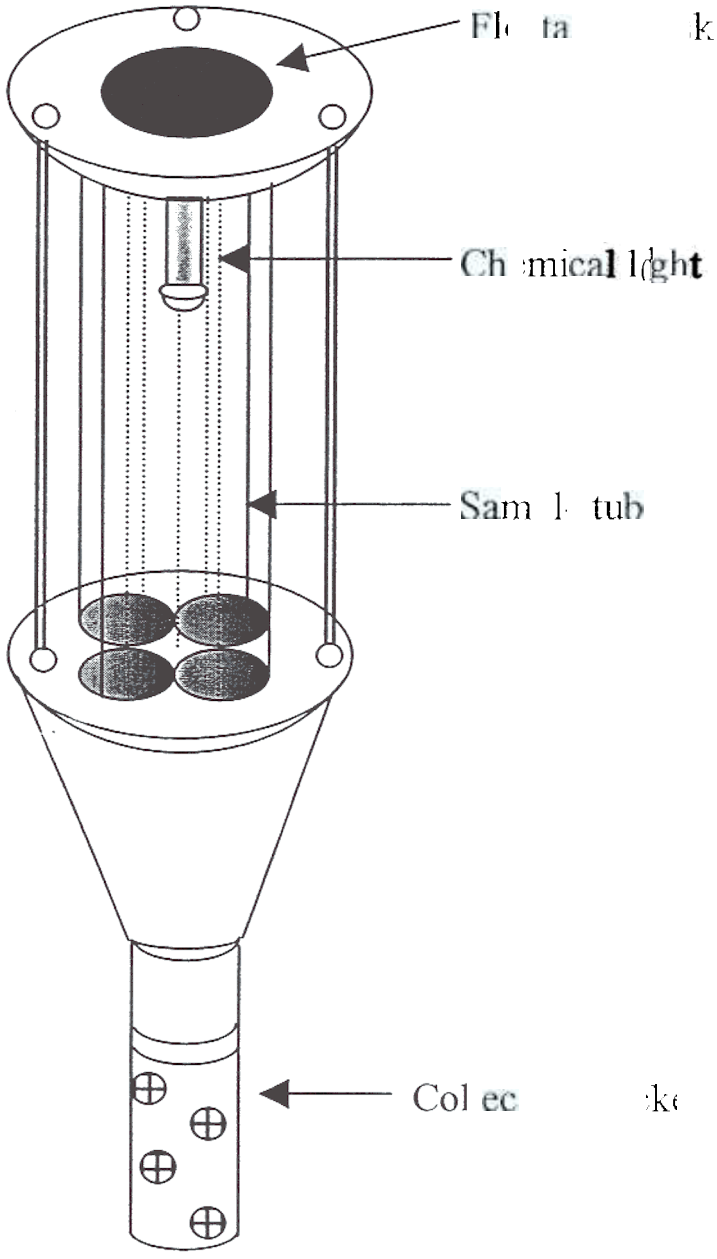
Trawl Tow Sites

Figure 2.1-1. Pelagic larval trawl locations in Onondaga Lake during 2001.



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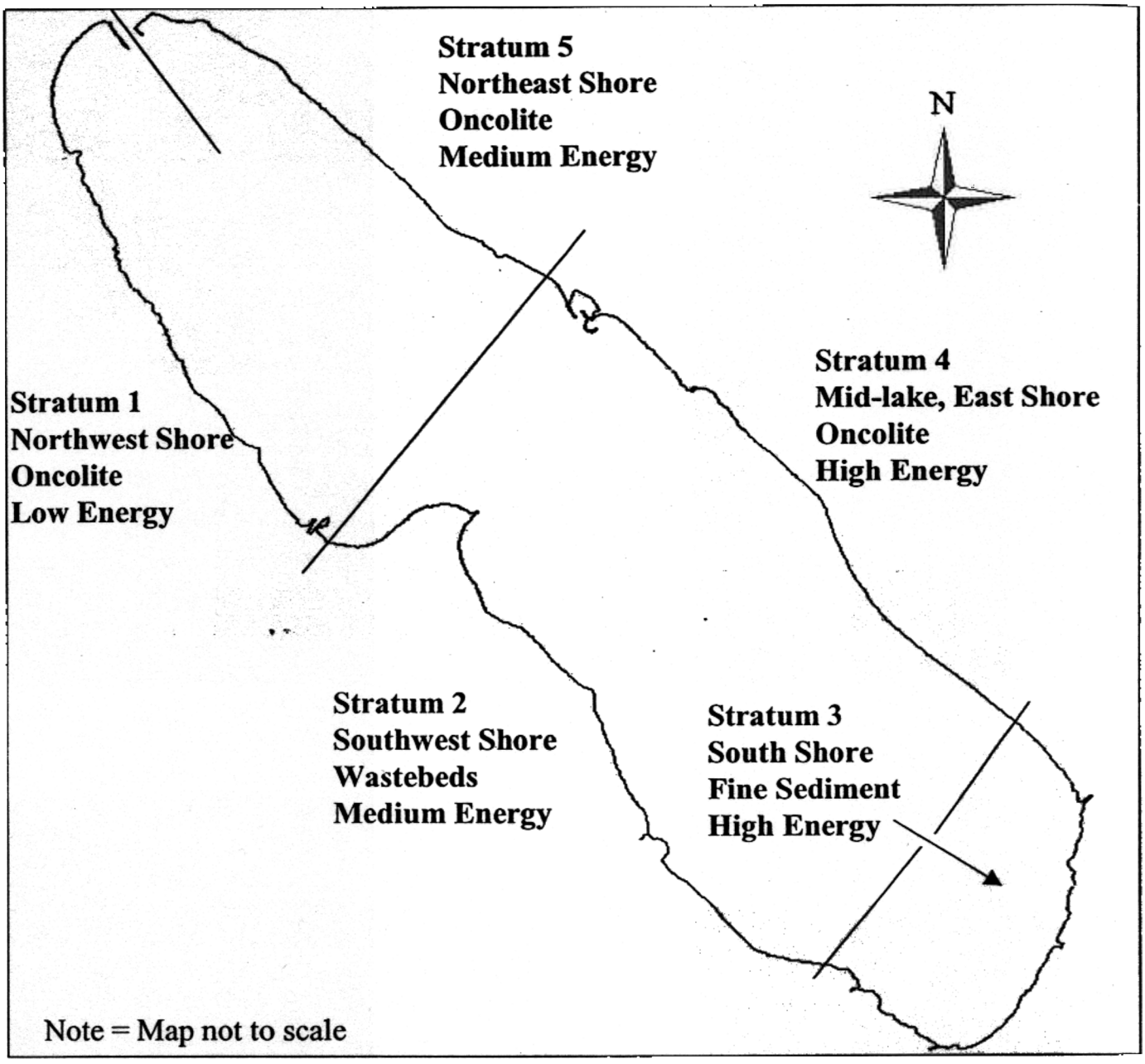
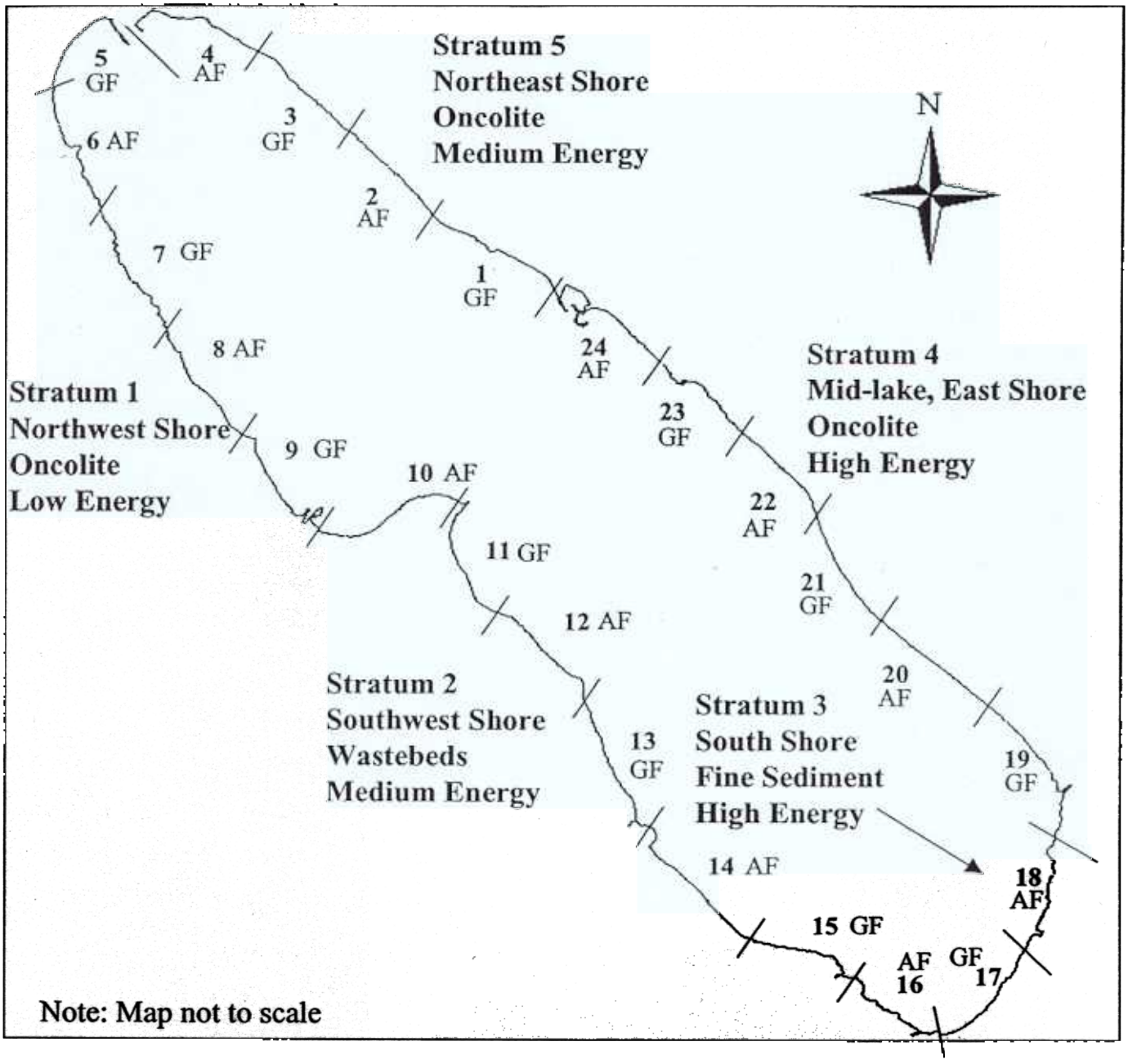


Figure 2.1-3. Location and description of strata sampled in Onondaga Lake during 2001.



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/ Transect Borders

AF = All Fish transects
GF = Gamefish Transects

Figure 2.1-4. Boat electrofishing transect locations in Onondaga Lake during 2001.

2.2 DATA ANALYSIS

2.2.1 Relative Abundance

Relative abundance for pelagic larvae sampled with Miller high-speed trawls was calculated as the number of larvae/m^3. The cross-sectional area of the trawl mouth opening and the estimated amount of water sampled from the flow meter readings were used to estimate volume sampled in m^3. CPUE or density is the number of fish in a tow divided by the volume sampled. Difference in the proportional species composition of the Miller trawl catch vs. the pelagic light trap catch, and the littoral seine catch vs. the littoral light trap catch, were tested using chi-square analysis. The null hypothesis for this comparison was no significant difference between the catch and composition of the light traps versus the Miller trawls and littoral seines. The proposal was to utilize light traps in place of the Miller trawls and littoral seines to assess the larval fish community. The similarities of the catch in the Miller trawl vs. the pelagic light trap, and the littoral seine vs. the littoral light trap, were expressed in terms of an index of proportional similarity (PS) (Brower et al. 1990), according to the formula:

$$PS = \Sigma \text{ [lowest percentage for species between the two gears]}$$

Littoral larvae or juvenile seine CPUE was calculated as the number of fish per seine haul.

Littoral or pelagic light trap CPUE was calculated as the number of fish captured per hour. The recorded length of time that each light trap was set (approximately 4 hours) represented the number of sampling hours and was divided into the fish catch.

Electrofishing CPUE was calculated as the number of fish per hour of electrofishing. number of seconds recorded for each electrofishing run was converted to a fraction of an hour and divided into the fish catch to give the number of fish per hour. When calculating average CPUE values, gamefish (see Section 2.1.4) and non-gamefish had to be treated separately. Gamefish were collected at all 24 transects per survey, while non-game species were only collected at 12 transects. Therefore, only the 12 transects at which all fish, including non-

gamefish, were counted could be used to calculate CPUE for non-game species. Complete results are presented in Appendix A.

The CPUE by age group (spring yearling, fall fingerling [i.e., young-of-the-year (YOY)], and older fish) for largemouth bass and smallmouth bass utilized the size cutoffs from the 2000 study, except for spring yearling smallmouth bass. The length frequency distribution for spring smallmouth bass in 2001 indicated that 180 mm would be a more appropriate maximum length cutoff for yearlings in 2001 study than the 200 mm cutoff used in year 2000 (Figures 2.2-1 and 2.2-2). The total number of bass in the appropriate length category was summed and divided by the effort for the season (spring or fall) to give catch-per-hour estimates.

2.2.2 Length, Weight, Condition, and Relative Weight

Mean total lengths and associated standard errors were calculated at the level desired (e.g. site, stratum, date) for each species by life stage.

The condition factor calculations used linear regression analysis of log weight plotted against log length, using each fish of the selected species as a data point. The slope of the resulting regression equation value of the equation log w = log a +b (log l) (where l = length and w = weight) is the "b" condition factor. Species collected in the electrofishing study and included in the analysis of condition factors were bluegill, pumpkinseed, smallmouth bass, and largemouth bass. Condition factors were also calculated for largemouth bass and smallmouth bass from the juvenile seine survey.

Relative weight (W_r) values were calculated by gear for the same species as used for the condition factor estimates. Published species-specific "standard weight" values (Anderson and Neumann 1996, Bister et al. 2000) were divided into the actual measured weight and multiplied by 100 to give the relative weight for each fish. Average relative weights and the associated standard error then were calculated for each species of interest.

Length frequency histograms were plotted for all species having 20 or more individual fish captured by electrofishing and measured in 2001

2.2.3 Juvenile Growth Rates

Instantaneous growth rate was calculated for juveniles (YOY) of the following species: tessellated darter, banded killifish, yellow perch, white perch, bluntnose minnow, gizzard shad, largemouth bass, *Lepomis* sp., pumpkinseed, and smallmouth bass. Instantaneous growth rates (G) were calculated for each sampling site and stratum, and for the whole lake, according to the formula $G = \ln (l_t / l_0)$, where l_0 and l_t are the mean lengths of YOY for a particular species in August and September, respectively.

2.2.4 Proportional Stock Density and Relative Stock Density

Proportional stock density (PSD) and relative stock density (RSD) indices were calculated for black crappie, bluegill, largemouth bass, pumpkinseed, and smallmouth bass from the electrofishing study. PSD is the number of fish that are of a "quality size" or longer, divided by the number of fish that are of a "stock size" or larger multiplied by 100. RSD is the number of fish larger than a specified size (e.g., "preferred" size), divided by the number of stock size fish and multiplied by 100. PSD and RSD give an indication of the recreational fishing opportunities in a lake for a given species. It also can suggest inter- and intra-specific competition dynamics if strong patterns emerge.

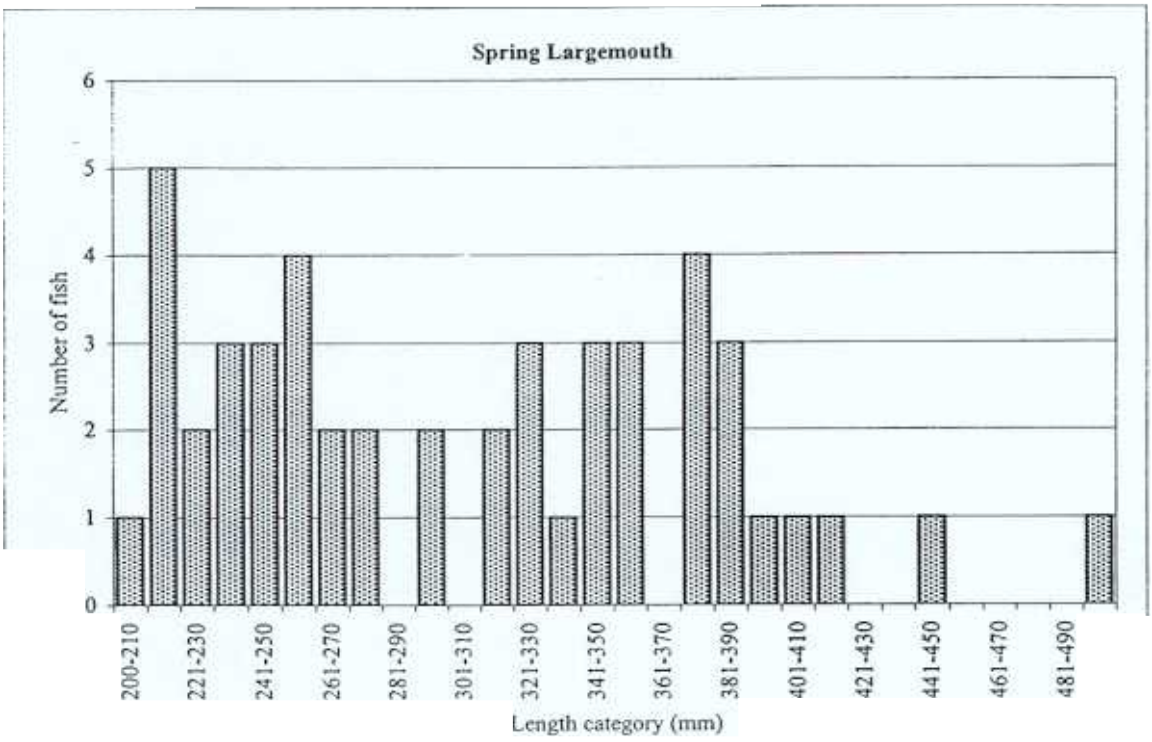
The PSD and RSD values were based on length categories provided in Anderson and Neumann (1996). RSD values were calculated for largemouth bass of 381 and 457 mm and smallmouth bass of 305, 356, and 457 mm.

The size categories used for calculation of PSD and RSD for each species were:

Species	Stock Size Lower limit	Quality Size Lower limit	Preferred Size Lower limit	Other Sizes Lower limit
Largemouth bass	200 mm (8 inches)	305 mm (12 inches)	381 mm (15 inches)	457 mm (18 inches)
Smallmouth bass	180 mm (7 inches)	280 mm (11 inches)	356 mm (14 inches)	305 mm (12 inches) 457 mm (18 inches)
Bluegill	80 mm (3 inches)	153 mm 6 inches)	203 mm (8 inches)	
Pumpkinseed	80 mm (3 inches)	153 mm (6 inches)	203 mm (8 inches	
Black Crappie	130 mm (5 inches)	200 mm (8 inches)	254 mm (10 inches)	

2.2.5 Community Indices

Community indices used in this report included total number of fish caught, species richness (number of species), and the Shannon-Weiner index. The number of fish caught and the species richness values are the sums of the respective variables. The Shannon-Weiner index is calculated as $H' = \Sigma\, p_i \log p_i$ where p_i is the proportion of the fish of species (i) in the total catch. All three of these indices can provide insight into whether progress is being made towards the Onondaga Lake restoration goals. A significant change in the number of species, catch rates and the Shannon-Weiner value could be indicative of improvement in Onondaga Lake.



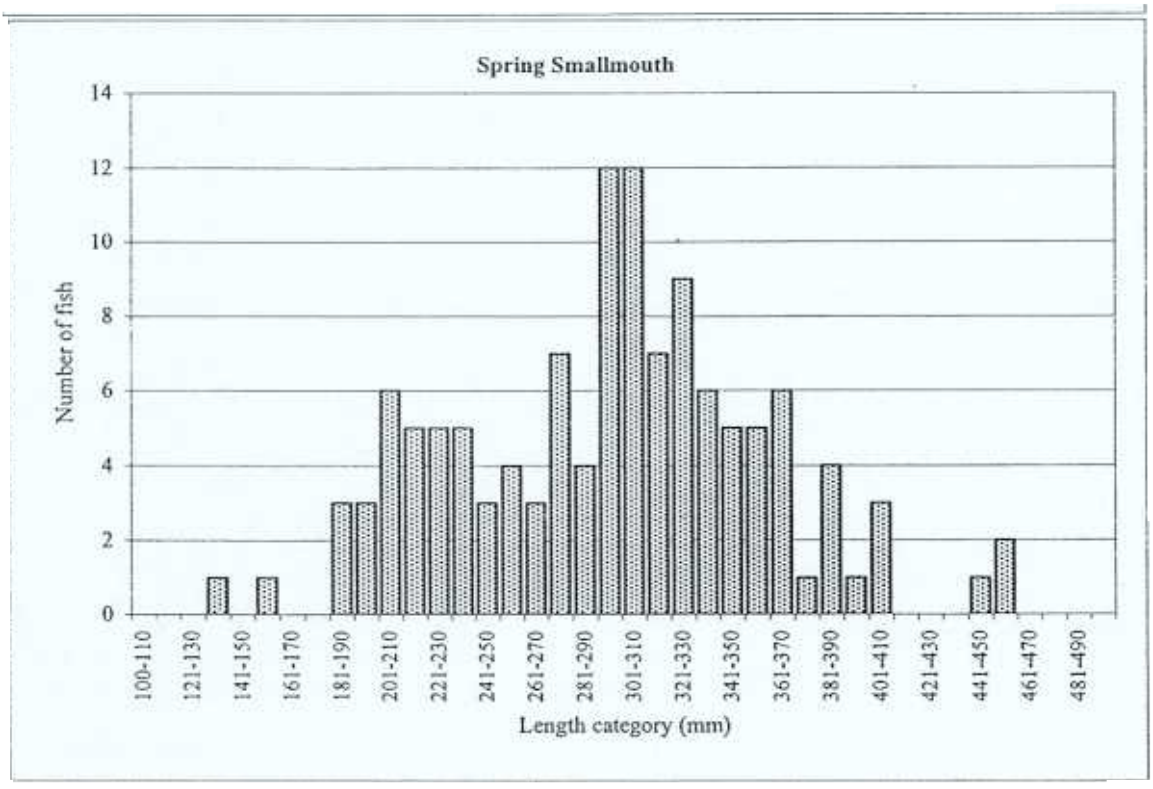


Figure 2.2-1. Length frequency distribution of largemouth and smallmouth bass from the spring 2001 Onondaga Lake AMP electrofishing sampling.

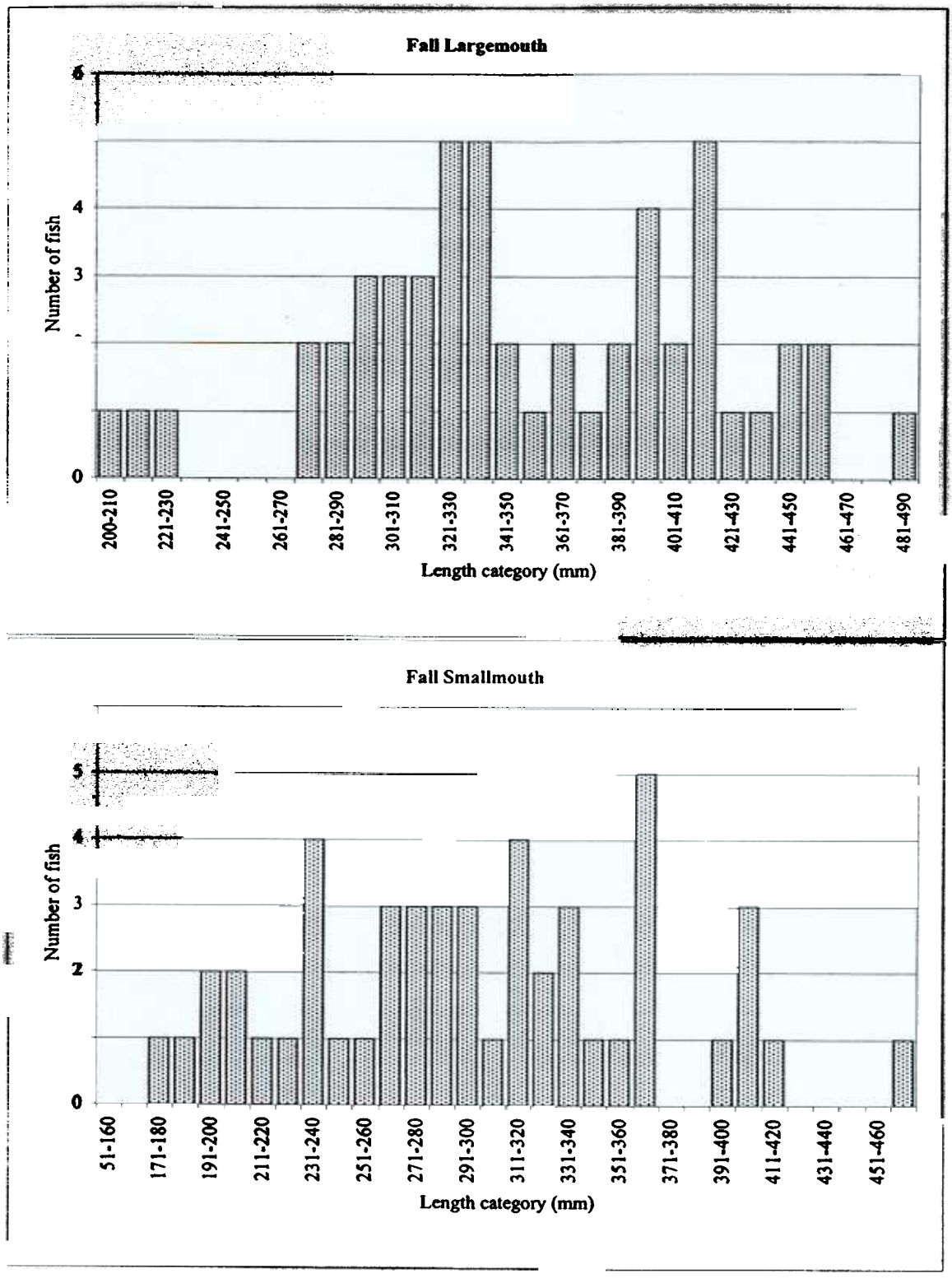


Figure 2.2-2. Length frequency distribution of largemouth and smallmouth bass from the fall 2001 Onondaga Lake AMP electrofishing sampling.

3.0 RESULTS

The results of the 2001 fisheries sampling program are summarized in this section, and comparisons are made to data collected during the 2000 program, where appropriate. Due to changes in several components of the monitoring program comparisons between year 2000 and 2001 are not a major emphasis of this study. Data from individual samples or sampling locations in 2001 are presented in Appendix Tables 1 through 13.

3.1 PELAGIC AND LITTORAL LARVAL FISH SURVEYS

For simplicity, the results of the pelagic and littoral larval fish surveys are expressed in terms of the number of "larvae" caught, whereas the catch could consist of the early juvenile life stage of fish, in addition to the larval life stage. Upon review of larval fish identified in 2000 by the Colorado State Larval Fish Laboratory two larvae identified as white bass have been re-identified as actually being one white perch and one *Morone* sp. These two fish were the only "white bass" captured in any of the sampling gears and for all life history stages in 2000. As such, the overall species richness for 2000 is now 32 instead of 33 and the larvae richness is now 18 instead of 19.

3.1.1 Species Composition

A total of 626 larval fish representing 12 species was collected in the combined pelagic and littoral sampling efforts in Onondaga Lake during 2001 (Tables 3.1-1 and 3.1-2). This represents a decline in the overall catch and number of species from 2000 (16,567 larvae and 18 species). The lower number of larval fish captured in 2001 was the result of less intensive sampling compared to the year 2000 program (252 pelagic samples in 2000 vs. 36 in 2001; 315 littoral samples in 2000 vs. 30 in 2001). The lower number of species in 2001 also may be an artifact of fewer samples. An increased number of samples would increase the probability of encountering the more uncommon taxa.

Common carp was the most commonly captured species in 2001, representing 45% of the combined catch of the larval fish gear (Figure 3.1-1). Gizzard shad represented 23% of this total

catch, *Lepomis* spp. represented 11%, and white sucker and brook silverside each represented 9%. Yellow perch, pumpkinseed, freshwater drum, golden shiner, white perch, largemouth bass and johnny darter together comprised the remaining 3% of the total catch.

Direct comparisons of the total catch data between the years 2000 and 2001 are difficult due to differences in identification level and sampling methods (inclusion of light traps in 2001). Figure 3.1-2A & B includes data only from the Miller trawl (common to both years) and standardizes the level of taxonomic identification in order to make such a comparison. The pelagic larval fish community was similar in both years, with members of the herring family dominating the catch (70-76% of the total catch; Figure 3.1-2A & B). Littoral seines showed the same four species being most abundant in 2001 as in 2000, but in different proportions (Figure 3.1-2C & D). In 2001, carp dominated the catch (58%) while white sucker, brook silversides and *Lepomis* spp. were nearly equally represented (12 to 14%). In 2000, *Lepomis* and brook silverside had comprised 88% of the catch, while carp and white sucker each represented only 3%.

3.1.2 Species Diversity and Richness

The Shannon-Weiner species diversity index, calculated for all larval fish samples combined, was 0.71 in 2001 (Table 3.1-3). The diversity indices from pelagic trawl tows and littoral seines alone were similar to the year 2000 results from each gear type (Table 3.1-3). Comparison of light trap diversity versus trawls and seines in 2001, however, yielded differing results. The species diversity in the pelagic light trap catches (0.59) was higher than in pelagic trawls (0.42), while diversity in littoral light traps (0.39) was lower than in littoral seines (0.54). These relatively low diversity values resulted from a preponderance of individuals in relatively few, dominating species.

Species richness (total number of species) for larval fish in 2001 was 12, compared to 18 in year 2000 (Table 3.1-4). The lower richness in 2001 was likely attributable to fewer samples collected than in 2000. Despite the smaller number of samples collected in 2001, the pelagic tows in 2001 captured one more species than in 2000 (six compared to five). Littoral seines, however, captured 10 fewer species in 2001 (eight) than in 2000 (18). Together, the pelagic and

littoral light traps in 2001 captured two fewer species than did pelagic trawl and littoral seines combined. Littoral light traps captured more species (six) than did pelagic light traps (four).

3.1.3 Relative Abundance

The mean CPUE for all species combined in 2001 was lower than in year 2000 for both the pelagic trawls (0.77/m^3 vs. 3.25/m^3) and the littoral seines (27/haul vs. 43/haul) (Figure 3.1-3A & B). CPUE for most species also was lower in 2001 than year 2000; the exceptions to this were for yellow perch in pelagic trawls (Figure 3.1-3A) and for carp and white sucker in littoral seines (Figure 3.1-3B). Some of the observed differences in CPUE may have been due to the reduced sampling effort in 2001, which resulted in fewer replicates and sampling events (every other week in 2000, monthly in 2001; Table 2.1-1).

Littoral light traps caught almost 13 times as many fish per hour than did pelagic light traps (Figure 3.1-4). All species captured in light traps, with the exception of yellow perch, were captured at higher rates in littoral light traps than in pelagic ones. Assuming that light traps sample the pelagic and littoral zones with equal efficiency, these results indicate that larval fish are more concentrated in the littoral zone of the lake than in the pelagic zone. This result is consistent with the fact that the larvae of many species inhabit shallow and calm water areas of lakes and rivers (Backiel and Welcomme 1980).

Although CPUE units fundamentally differ for light traps, Miller trawls and seines, the relative abundance of individual species based on CPUE can be compared among the gear types. While keeping in mind the very small sample sizes involved, the pelagic samples from the Miller trawl and the pelagic light trap appeared to be similar in that gizzard shad and yellow perch are common species in both gears (Figure 3.1-5A). However, carp and *Lepomis* spp. comprised a larger percentage of the light trap catch than of the trawl catch. When analyzed by a chi-square test, the proportional species composition differed significantly between the Miller trawl catch and the pelagic light trap catch (Table 3.1-5).

In the littoral zone, only the relative abundance of *Lepomis* spp. was similar between the seine and the light trap catches (Figure 3.1-5B). Like the pelagic sampling gears, the proportional species composition differed significantly between the littoral seine catch and the littoral light trap catch (Table 3.1-5). The difference in species composition between the littoral seine catch and the littoral light trap catch was even more pronounced than between the two pelagic larval gear types, as indicated by a proportional similarity index of only 0.261 compared to the proportional similarity index of 0.455 for the Miller trawl and pelagic light trap catches (Table 3.1-5).

As discussed previously, the small sample sizes preclude making confident statements regarding comparisons between the light traps and the other two gear types. Given that the there were notable differences in the composition of the catch between gear types and one of the goals of this monitoring program is to describe the fish community it would be valuable to keep all three gear types. A study examining the relative selectivity's of Miller trawls and light traps suggests that larval sampling programs utilize a mix of passive and active gear to alleviate bias (Gregory and Powles 1988)

Differences in species composition within the littoral light trap and seine catches may have been due to the timing of sampling; seining occurred in daylight and traps were fished at night. Diel onshore and offshore movements could explain these differences, particularly the absence of gizzard shad from the daytime seine samples.

Table 3.1-1. Total catch of larval fish during 2001 in the pelagic and littoral zones using Miller High speed trawls, larval fish seines and light traps.

Species	Pelagic Total Catch		Littoral Total Catch		Entire Lake Total Catch
	Trawl	Light Trap	Seine	Light Trap	All gear
Carp	-	3	238	36	277
Gizzard shad	23	5	-	117	145
White sucker	2	-	56	-	58
Brook silverside	-	-	57	-	57
Bluegill	1	-	46	7	54
Yellow perch	4	3	8	-	15
Pumpkinseed	-	4	2	6	12
Freshwater drum	1	-	-	1	2
Golden shiner	-	-	2	-	2
White perch	2	-	-	-	2
Largemouth bass	-	-	-	1	1
Johnny darter	-	-	1	-	1
Total	**33**	**15**	**410**	**168**	**626**

Table 3.1-2. CPUE of larval fish by species in each sampling gear used in the 2001 larval fish program. Note that direct comparison of CPUE for different sampling gears is not appropriate (i.e. light traps vs. trawls) due to differing units of effort.

Species	Pelagic	Littoral	Pelagic	Littoral
	Light Trap (#/Hr)	Light Trap (#/Hr)	Trawl (#/m^3)	Seine (#/Haul)
Carp	0.05	0.56	-	15.8
Gizzard shad	0.08	1.77	0.49	-
White sucker	-	-	0.07	3.7
Brook silverside	-	-	-	3.8
Bluegill	-	0.12	0.01	3.1
Yellow perch	0.05	-	0.14	0.5
Pumpkinseed	0.03	0.09	-	0.1
Freshwater drum	-	0.02	0.01	-
Golden shiner	-	-	-	0.1
White perch	-	-	0.04	-
Largemouth bass	-	0.02	-	-
Johnny darter	-	-	-	0.1
Total	**0.20**	**2.58**	**0.77**	**27.30**

Table 3.1.3. Shannon-Weiner diversity indices for larval fish in all sampling gear types in 2001 and 2000. NC=not calculated. Note: no light traps were used in 2000.

	Pelagic Tows	Pelagic Light Traps		Littoral Seines	Littoral Light Traps	All Samples
2001 Shannon-Weiner Diversity	0.418	0.592		0.543	0.388	0.7084
2000 Shannon-Weiner Diversity	0.37	-		0.58	-	NC

Table 3.1.4. Species richness for larval fish in all sampling gear types in 2001 and 2000. Note that in 2000 larval fish were identified to the family through species levels depending on the organism, while in 2001 all fish were identified to species. The species richness for 2000 takes into account the number of distinct species identified.

	Pelagic Tows	Pelagic Light Traps		Littoral Seines	Littoral Light Traps	All Samples
2001 Species Richness	6	4		8	6	12
2000 Species Richness	5	-		18	-	19

Table 3.1-5. Proportional similarity analysis of whole lake larval survey catches to compare gear types in the 2001 Onondaga Lake AMP.

Miller high-speed trawl			Pelagic light traps		
Species	*Number*	*Percentage of catch*	*Species*	*Number*	*Percentage of catch*
Gizzard shad	23	69.70	Gizzard shad	5	33.33
Yellow perch	4	12.12	Pumpkinseed	4	26.67
White perch	2	6.06	Carp	3	20.00
Freshwater drum	1	3.03	Yellow perch	3	20.00
White sucker	2	6.06	Bluegill	0	0.00
Bluegill	1	3.03	Freshwater drum	0	0.00
Carp	0	0.00	White perch	0	0.00
Pumpkinseed	0	0.00	White sucker	0	0.00

Proportional similarity between Miller high-speed trawls and larval light traps = 0.455

Chi-Square test (2 x 4)
Overall chi-square value = 16.64
P-value = 0.0008
Degrees of freedom = 3

Littoral larval seines			Littoral light traps		
Species	*Number*	*Percentage of catch*	*Species*	*Number*	*Percentage of catch*
Carp	238	58.05	Gizzard shad	117	69.64
Brook silverside	57	13.90	Carp	36	21.43
White sucker	56	13.66	Bluegill	7	4.17
Bluegill	46	11.22	Pumpkinseed	6	3.57
Yellow perch	8	1.95	Freshwater drum	1	0.60
Golden shiner	2	0.49	Largemouth bass	1	0.60
Pumpkinseed	2	0.49	Brook silverside	0	0.00
Johnny darter	1	0.24	Golden shiner	0	0.00
Freshwater drum	0	0.00	Johnny darter	0	0.00
Gizzard shad	0	0.00	White sucker	0	0.00
Largemouth bass	0	0.00	Yellow perch	0	0.00

Proportional similarity between larval seines and larval light traps = 0.261

Chi-Square test (2 x 6)
Overall chi-square value = 338.0
P-value = 0.0000
Degrees of freedom = 5

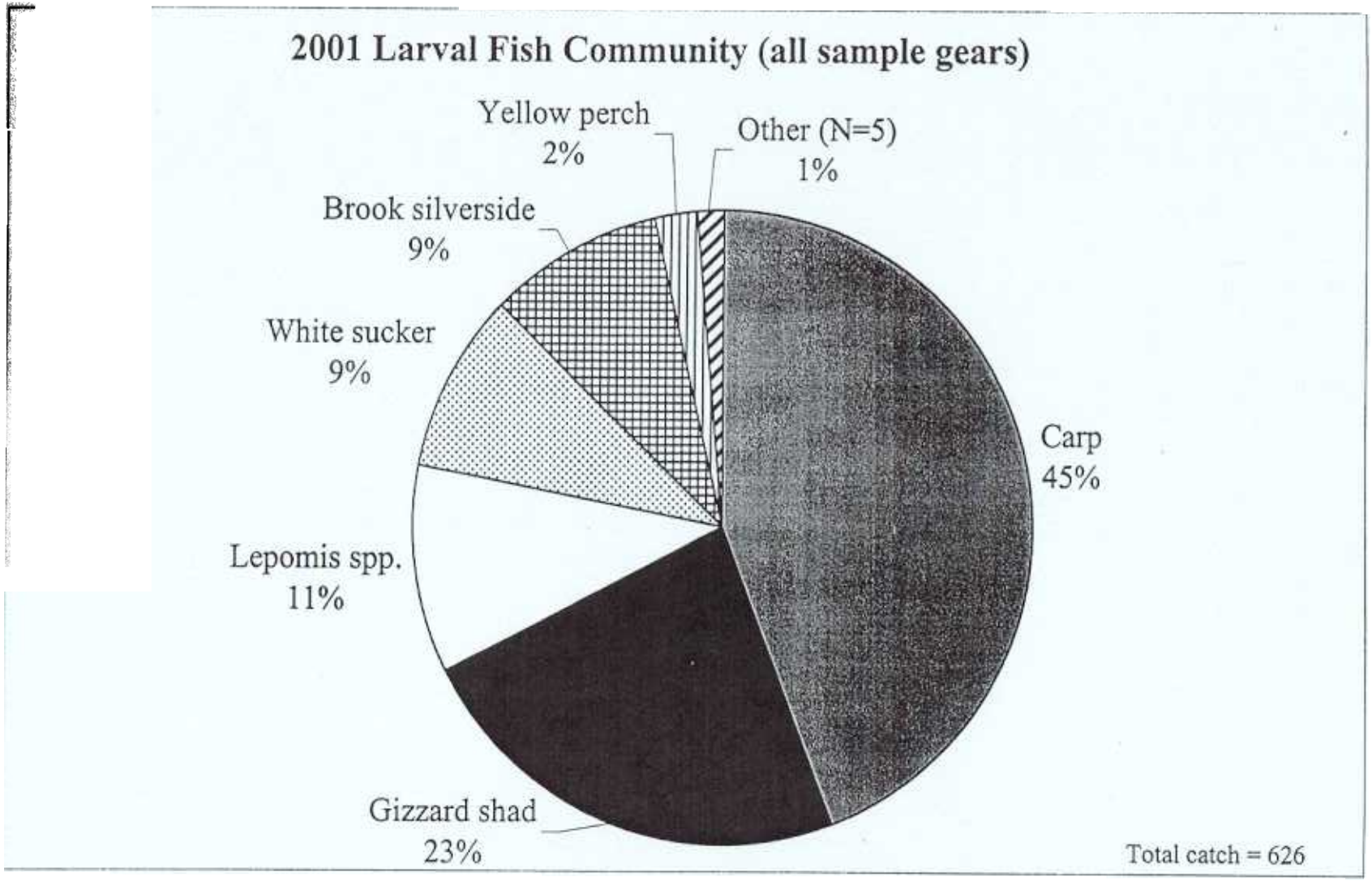


Figure 3.1. 1. Larval fish species captured during the 2001 sampling effort.

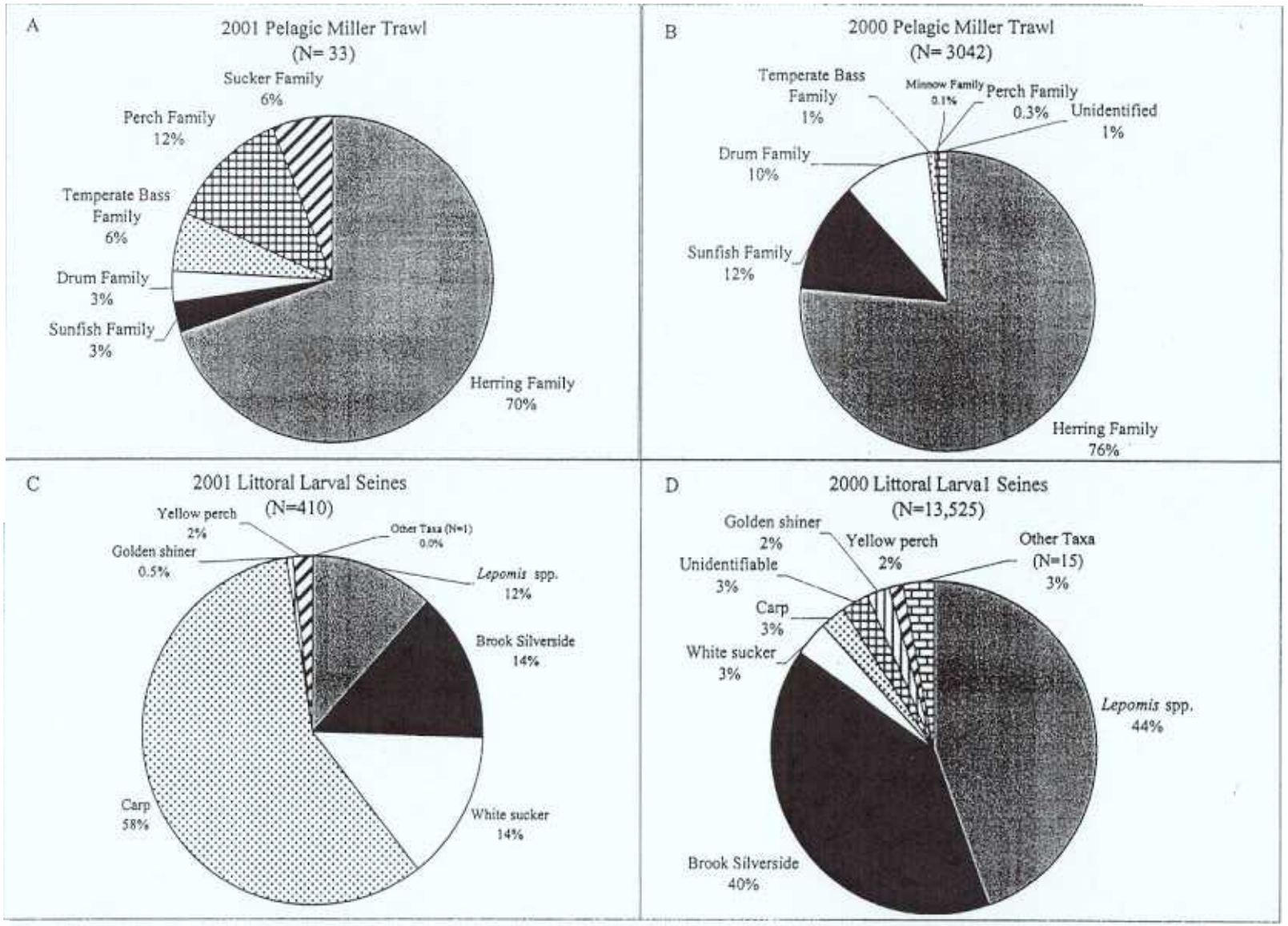


Figure 3.1-2. Comparison of larval fish catch in 2001 and 2000 by gear type. Note that fish from the pelagic trawls for 2001 were grouped into families to be consistent with year 2000 data, although identification was to species . *Lepomis*p. are probably represented by both pumpkinseed and bluegill. N is the number of fish captured.

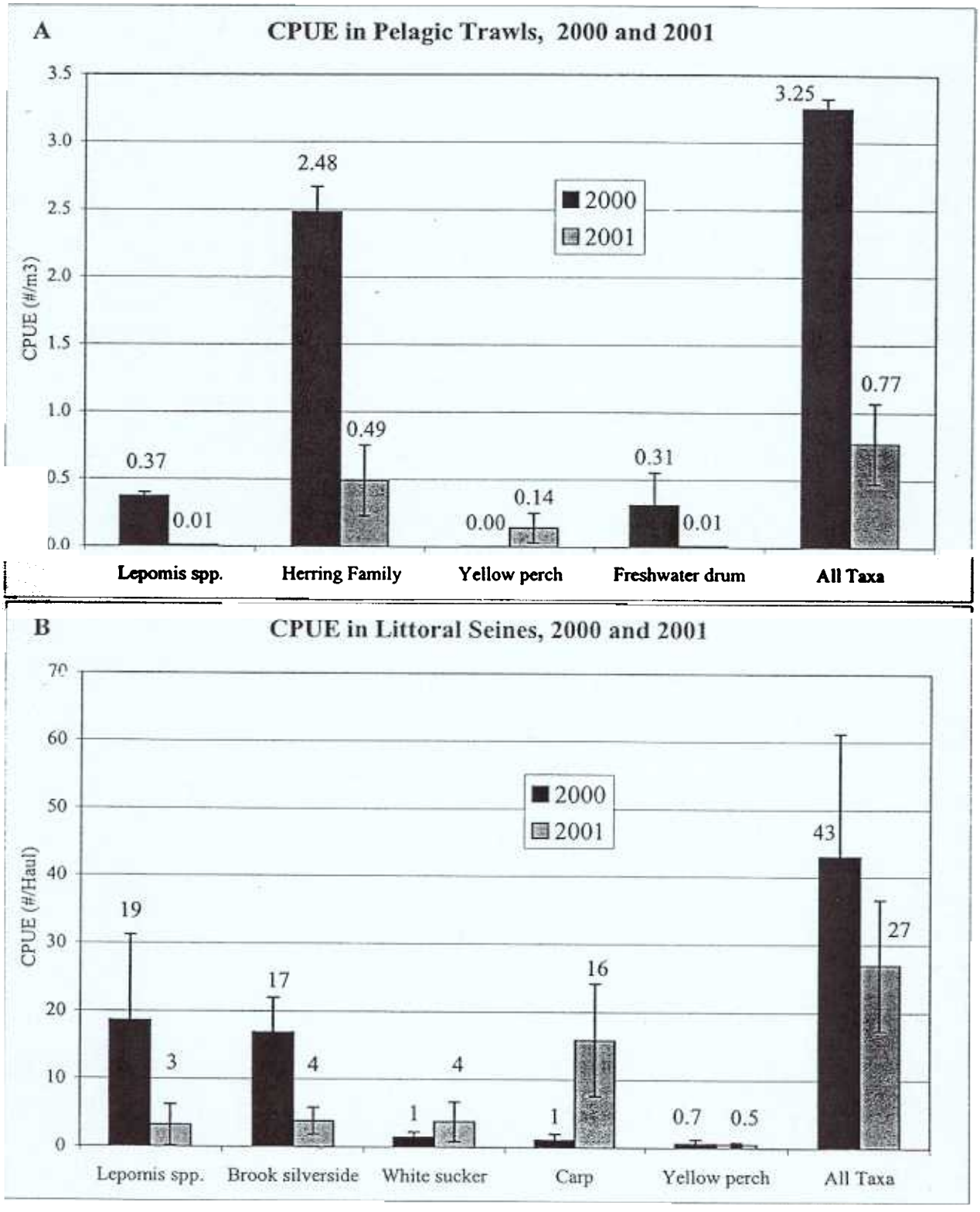


Figure 3.1-3. CPUE of selected taxa captured in pelagic Miller High Speed Trawls and littoral larval seines in 2001 and 2000.

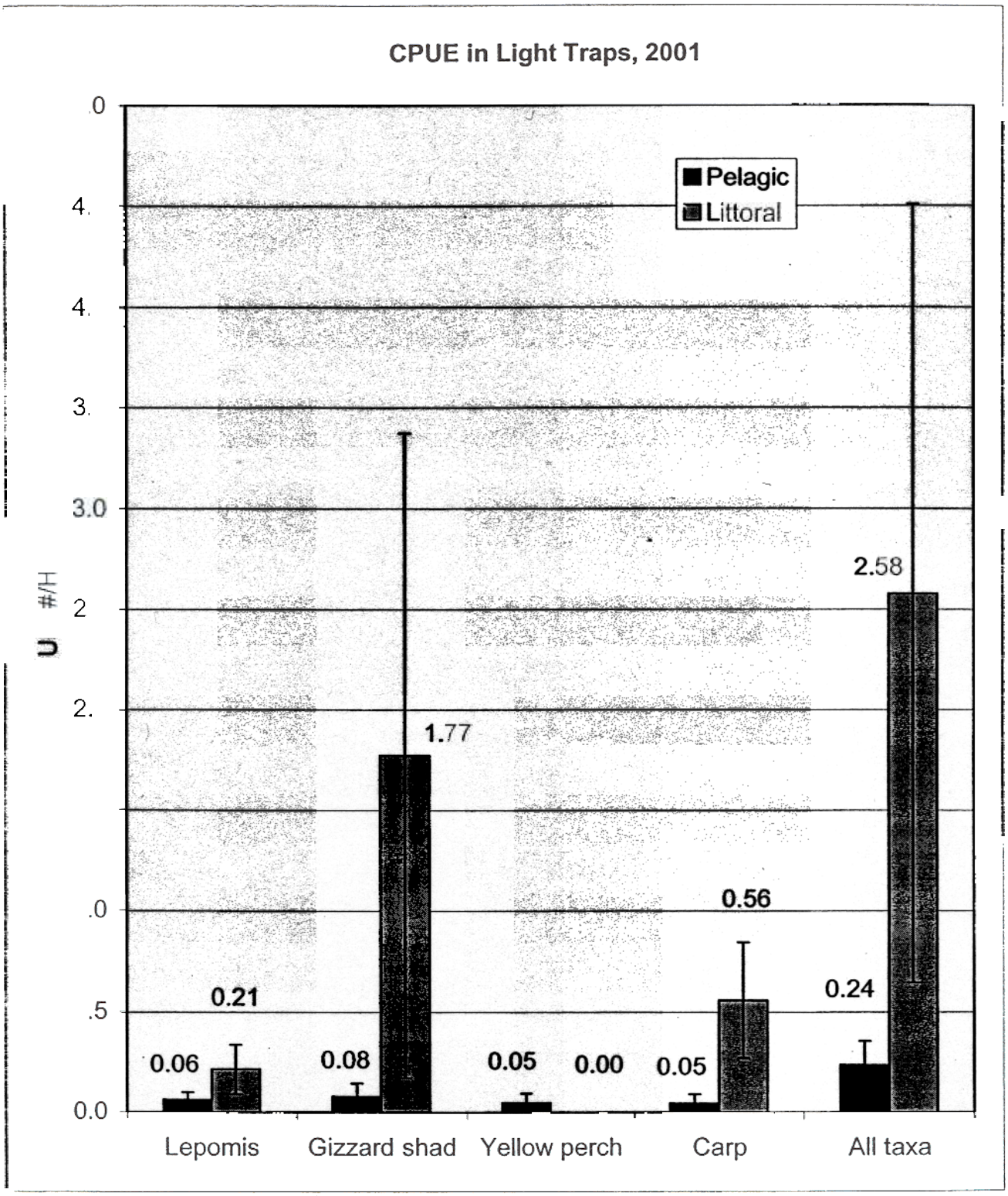
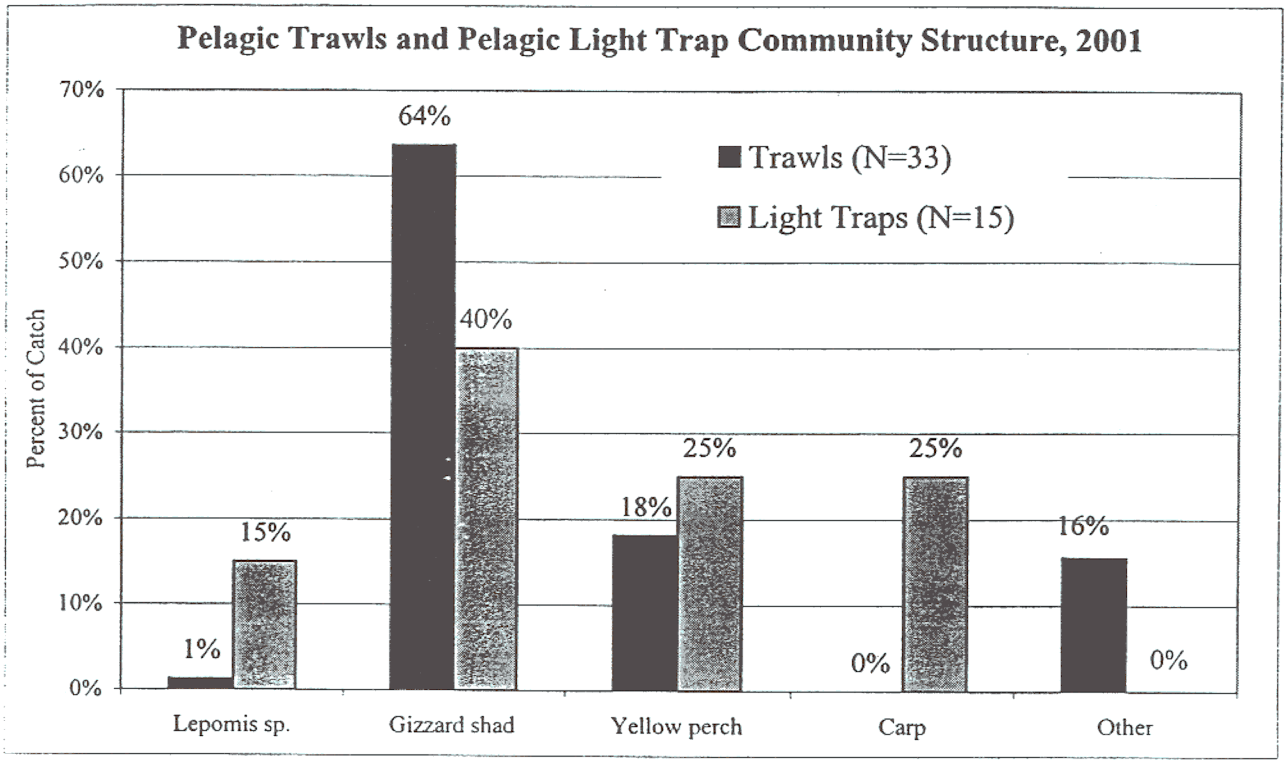


Figure 3.1-4. CPUE for selected species larval light traps during 2001



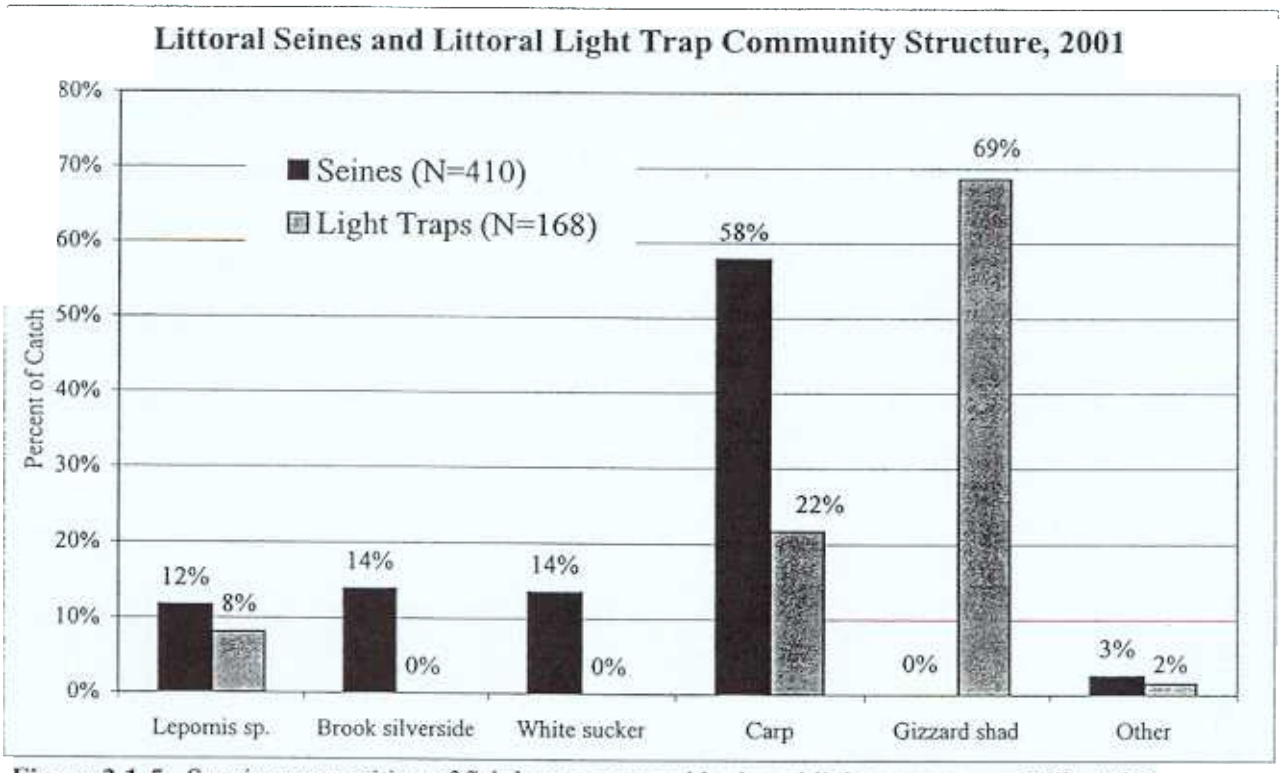


Figure 3.1-5. Species composition of fish larvae captured by larval light traps versus Miller High Speed Trawls and seines in 2001 (N is the number of fish captured).

3.2 JUVENILE FISH SEINING

Although seining in the littoral zone of Onondaga Lake targeted the juvenile (young-of-the-year or YOY) life stage, the catch also included adult or non-YOY fish. The following section addresses only those fish determined to be YOY, based on length frequency data for each species and sampling month. The breakdown of the seine catch by YOY and non-YOY is presented in Table 3.2-1.

3.2.1 Species Composition

A total of 8163 YOY fish, representing 18 species (*Lepomis* consisting of bluegill and pumpkinseed), were collected by littoral seining in 2001 (Table 3.2-2). *Lepomis* (68%) was by far the most abundant species, with gizzard shad (19%) also being common. Of the remaining 16 species, only yellow perch (4.0%), largemouth bass (3.1%), and smallmouth bass (2.4%) comprised more than 1% of the total catch. In 2000, gizzard shad represented 66% of the catch, and *Lepomis* spp. represented 24% of the catch (Figure 3.2-1). The apparent reversal in the relative abundance of these two species appeared to be related to increased abundance of *Lepomis* spp. rather than to decreased abundance of gizzard shad. The dominance of *Lepomis* spp. in 2001 closely resembled the community structure in 1993 and 1994, when *Lepomis* spp. represented 60% and 91% of the total YOY catch (Arrigo 1998) (Figure 3.2-1). The presence of substantial numbers of yellow perch YOY in 2001 was also noteworthy, as they were not captured in year 2000.

Fisheries surveys between 1991 and 2001 have found a total of 26 fish species occurring as YOY in Onondaga Lake (Table 3.2-3). Of these 26 species, only *Lepomis* (bluegill and pumpkinseed), largemouth bass, banded killifish, and white sucker were caught in every survey throughout this time, while 11 species were captured in only one of the six surveys. *Lepomis*, gizzard shad, yellow perch and largemouth bass apparently are the most productive species consistently reproducing in the lake, contributing more than 1% of the YOY catches in at least four of the surveys. While always present, the white sucker most likely spawns in tributaries to the lake and not within the lake itself.

In most years, two species (e.g., *Lepomis* and gizzard shad) typically have dominated the YOY catch. The presence of YOY yellow perch has been sporadic annually; they were absent from catches in two of the six survey years. Although YOY smallmouth bass were caught in most years, their numbers increased in 2000 and 2001 to represent over 1% of the total catch. The apparent increase in abundance of YOY smallmouth bass in the 2000 and 2001 was corroborated by the 2000 and 2001 nesting surveys confirming spawning activity, whereas no spawning activity was observed in the 1990's (Arrigo 1998).

The two species most frequently captured during larval sampling, *Lepomis* spp. and gizzard shad, were examined in terms of their spatial distribution as YOY (Figure 3.2-2). Most *Lepomis* were found in Strata 3 and 4 (south and southeast shores) in both 2001 and 2000 (Figure 3.2-2A and B). Stratum 2, characterized by wastebeds, produced very few YOY *Lepomis* in either year, presumably due to the lack of appropriate spawning and nursery habitat. Almost the entire catch of gizzard shad came from Strata 2 and 3, i.e., primarily within the south basin of the lake, in both 2001 and 2000 (Figure 3.2-2C and D).

3.2.2 Species Diversity and Richness

For 2001, the Shannon-Weiner species diversity index for YOY within the entire lake was 0.47, with indices for individual strata ranging from 0.21 to 0.51 (Figure 3.2-3A). For 2000, the diversity index for the entire lake was 0.73, with indices for individual strata ranging from 0.31 to 0.58 (Figure 3.2-3A). The relatively low diversity values in both years are a result of the dominance of *Lepomis* and gizzard shad. Although diversity within strata varied considerably between years, Stratum 2 (wastebeds) had the lowest diversity in both years.

The species richness value for YOY fish in 2001 was 18, compared to 14 species collected in 2000 (Figure 3.2-3B). In fact, more species were collected in 2001 than in any of the five previous surveys (range 7 to 16, Table 3.2-3). Four species were collected in 2001 that had not been previously found as YOY: tessellated darter, bluntnose minnow, Johnny darter and longnose dace. Eight species found as YOY in previous years were not caught in 2001 and included longnose gar, northern hogsucker, alewife, rock bass, rainbow smelt, northern pike, freshwater

drum, and black crappie. Most of the species missing during 2001 could be considered uncommon or rare, and thus might not have been caught due to the reduced sampling effort in 2001 compared to 2000.

YOY yellow perch were collected in substantial numbers in 2001 but were completely absent from catches in 2000. This probably indicates successful reproduction for yellow perch during 2001, while there may have been reproductive failure for yellow perch during 2000.

The pattern of species richness among the five strata seen during 2001 resembled that seen in 2000 (Figure 3.2-3B). Most strata had 10 to 15 species, except for Stratum 2, where the number of species caught was only eight in 2001 and six in 2000. The habitat in Stratum 2 is characterized as wastebeds.

The overall increase in richness and decrease in diversity from 2000 to 2001 is due to the greater dominance of a few species in 2001 that ameliorated the affect of increased number of species in the diversity measure.

3.2.3 Relative Abundance

The mean CPUE for all species combined in August and September 2001 of 136/haul was 67% more than during the same months in 2000 (83/haul) (Figure 3.2-4), largely the result of an increase for *Lepomis* spp. (92/haul in 2001, compared to 13/haul in 2000). Other species showing an increased CPUE in 2001 included yellow perch (5.6/haul vs. 0/haul), largemouth bass (4.3/haul vs. 0.8/haul) and smallmouth bass (3.3/haul vs. 1.9/haul) (Figure 3.2-4). Gizzard shad CPUE declined from 58/haul to 26/haul. The changes from 2000 to 2001 may reflect variability in reproductive success.

3.2.4 Length, Relative Weight, Condition and Growth Rates

Lepomis spp., largemouth bass, smallmouth bass, and gizzard shad were larger in August 2001 than in August 2000 (Figure 3.2-5A). Largemouth bass showed the greatest difference in size, averaging about 36% larger in August 2001 compared to August 2000. *Lepomis* spp.,

smallmouth bass, and gizzard shad were 29%, 23%, and 10% larger in 2001 than in 2000, respectively.

Differences in average size between years may be due to factors including time of spawning, temperature, forage availability, size-selective predation, and inter- and intra-specific competition. Water temperature data from Onondaga County's monitoring buoy (depth of 2 m) indicated that 2001 may have been warmer than 2000 during the critical time for spawning and growth (May-August) (Figure 3.2-5B). The warmer water temperatures in May and June 2001 could have allowed earlier spawning than in year 2000, thus allowing more growth time prior to capture in August. OCDWEP personnel observed large numbers of fish nests in the lake starting in mid-May 2001, while nests were not observed in 2000 until early June. The increased water temperatures in 2001 also may have improved the food availability and growth rates for YOY fish.

Relative weight (W_r) can be used to compare growth conditions temporally or spatially. In general fish in good condition have a W_r of about 100 (Anderson and Neumann 1996). When W_r is substantially below 100, problems may exist in food or feeding conditions. When values are well above 100, prey may be overabundant (Anderson and Neumann 1996). The comparison of these metrics for YOY bass over time will help to determine the changes in relative fitness of bass over the course of the AMP.

The W_r for largemouth bass and smallmouth bass YOY in 2001 varied little by stratum. Largemouth bass W_r averaged 114, indicating that the population was in better than average condition (Figure 3.2-6A&B). Smallmouth bass mean W_r in 2001 was 95, also indicating that they are in generally good condition.

Another measure of growth conditions for fish is the condition factor, which is the slope of a length-weight regression. Typically values are near 3.0 for fish (Anderson and Neumann 1996). The condition factor for YOY largemouth bass was consistent among strata and averaged 2.9 (Figure 3.2-6C). Condition factor values for smallmouth bass however varied by stratum, with values of 2.2 for Stratum 2 (SW shore) and 2.1 for Stratum 4 (SE shore) being lower than for the

other three strata (range of 2.8 to 3.3). This may indicate that areas of the lake do not provide the same feeding opportunities or habitat for smallmouth bass.

Lakewide W_r for YOY largemouth bass and smallmouth bass was 22% and 25% lower, respectively, in 2001 than in 2000 (Figure 3.2-6). Likewise, lakewide condition factor values for largemouth bass and smallmouth bass YOY were 12% and 6% lower, respectively, in 2001 than in 2000 (Figure 3.2-6). These differences may indicate density dependent effects, since the YOY population size of both species in 2001 was apparently much larger than in 2000 (2.4 times larger for smallmouth bass and 4.1 times larger for largemouth bass). An increase in population density may have increased intra-specific competition for food and decreased individual fish foraging success, thus leading to poorer average condition of the individual fish (Van Den Avyle 1993).

Instantaneous growth rate (G) is the rate of change in size (total length) over a given time interval. Length data were available from August and September in 2001 to calculate G. Growth rates vary naturally between years and can be affected by many factors, including density-dependent factors (e.g., food competition) or density-independent factors (e.g., temperature). Trends in growth rates over many years may help illustrate any impacts of Metro upgrade measures on the YOY community and/or help to explain observed differences in the community. Instantaneous growth rates in 2000 and 2001 are presented for selected species in Figure 3.2-7.

For the three species where comparable data were available in both years, two (smallmouth bass and *Lepomis* spp.) grew at slower rates in 2001 than in 2000 and one (gizzard shad) grew at a faster rate. Both species that grew more slowly in 2001 were 2 to 7 times more abundant in 2001 than in 2000. Conversely, gizzard shad was half as abundant in 2001 than year 2000. Density-dependent factors may have influenced growth rates, in addition to condition and relative weight, as previously discussed. Even though YOY largemouth bass and smallmouth bass were larger in August 2001 than in August 2000 earlier nest building and spawning may have more than offset the slower growth rate in 2001.

Table 4.2-1. Species captured by year and their spawning characteristics .

Species	Spawning habitat	Spawning season/temperature	2000	2001
Alewife	Shallow water	Spring 11°C		
Banded killifish	Shallow water / streams	Spring 21°C		
Black crappie	Sandy bottom w/weeds	Spring 20°C		X
Bluegill	Firm sand or mud	Late spring		
Bluntnose minnow	Rocky substrate	Late spring 19-27°C	X	
Bowfin	Vegetation/ woody debris	Late spring 16-19°C	X	X
Brook silverside	Gravel bottom	Late spring		
Brook stickleback	Muck bottom/vegetation	Spring 4-10°C		X
Brown bullhead	Natural structure	Spring 27°C	X	
Brown trout *	Gravel bottom	Fall / early winter	X	
Carp	Shallow weedy flats	Spring/summer 17°C+		
Channel catfish	Natural structure	Late spring 24-29°C	X	X
Emerald shiner	Natural structure	Spring/summer 24°C	X	
Fathead minnow	Natural structure	Spring/summer 16-18°C		
Freshwater drum	Planktonic egg	Summer/fall		
Gizzard shad	Broadcast spawner	Spring 10-21°C		
Golden shiner	Vegetation	Late spring 20°C		
Johnny darter	Rocky substrate	Spring		X
Largemouth bass	Firm sand or mud	Spring		
Logperch	Streams and sandy shoals	Late spring		
Longnose dace *	Gravel streams	Spring		X
Longnose gar	Lake shallows and streams	Spring/early summer		X
Northern hog sucker *	Gravel streams	Spring	X	
Northern pike	Vegetation / marshes	Early spring 4.4 - 11°C	X	X
Pumpkinseed	Shallow vegetation	Spring 18-20°C		
Rock bass	Gravel/mud/vegetation	Late spring 20-23°C	X	X
Shorthead redhorse *	Gravel streams	Spring		X
Smallmouth bass	Shallow water gravel	Spring 17-18°C		
Tessellated darter	Gravel bottom	Spring		X
Tiger muskellunge	Stocked hybrid	Not applicable		X
Walleye	Gravel in streams or lake shoals	Early spring 2-7°C	X	X
White perch	Lower reaches of streams or gravelly shoals of lakes	Spring 18-20°C		
White sucker *	Gravel streams	Spring 6-12°C		
Yellow perch	Shallows over structure	Spring 7-11°C		

Key:

	= Present as YOY and adult
X	= Present as Adult Only
	= Not Present in that year

sp. spawning in lake = 21
spawning in tribs. = 3
sp. observed as adults only = 10

* = Exclusive stream spawning species

Note: Spawning information obtained from Smith 1985, Becker 1983, and www.dnr.cornell.edu.

4.3 RECREATIONAL FISHING OPPORTUNITIES

Ten of the 14 species considered to be gamefish in the AMP were caught in the 2001 electrofishing survey:

Largemouth bass	Brown bullhead
Smallmouth bass	Yellow perch
Walleye	Black crappie
Bluegill	Northern pike
Pumpkinseed	Rock bass

These 10 species accounted for 29.2% of the total CPUE, compared to 12 species and 17.3% of the catch for the 2000 electrofishing survey (Table 3.3-1). The most abundant gamefish in both surveys were yellow perch and bluegill. Other gamefish species contributing more than 1% of the total CPUE in 2001 were largemouth bass, pumpkinseed, and smallmouth bass.

In order to compare the abundance of gamefish in Onondaga Lake to that for other New York State lakes, the mean CPUE for six gamefish species in during 2001 electrofishing is compared to statistics presented by Brooking et al. (2001a) for Canadarago Lake (Otsego County) in the table below:

Species	Canadarago Lake Range of CPUE (fish/hour)	Onondaga Lake 2001 Mean CPUE (fish/hour)
Largemouth bass	4.8-19.2	6.49
Smallmouth bass	1.1-18.8	11.36
Walleye	11.0-44.3	1.31
Bluegill	16.0-60.0	21.28
Pumpkinseed	23.0-46.0	15.34
Yellow perch	26.0-77.0	24.20

Canadarago Lake is similar in size and mean depth (2,000 acres and 25 ft., NYSDEC 1986) to Onondaga Lake (2,965 acres and 36 ft., Effler 1996). Based on their relative abundance during 2001, the recreational opportunity afforded by Onondaga Lake should be similar to what is

available in Canadarago Lake for three of the six species (largemouth bass, smallmouth bass and bluegill) and only slightly less than in Canadarago Lake for yellow perch. Canadarago Lake appears to have more pumpkinseeds and walleye than does Onondaga Lake.

Brooking et al. (2001b) compiled electrofishing CPUE data, using the same collection procedures as used on Onondaga Lake, from five additional New York State lakes, as presented below:

	Range of CPUE values					
Species	**Findley Lake**	**Sixtown Pond**	**Cayuta Lake**	**Eaton Brook Reservoir**	**Swinging Bridge Res.**	**Onondaga Lake 2001**
Largemouth bass	13.1	10.1-22.0	22.1-34.7	33.7-52.4	2.7-11.7	6.49
Smallmouth bass	16.6	0.6	0	6.3-9.0	24.6-26.4	11.36
Walleye	7.2	11.8-27.5	2.0-22.5	2.3-4.2	1.1-8.4	1.31
Bluegill	67.0	121.0-127.0	395.0-608.0	160.0-215.0	72.0-272.0	21.28
Pumpkinseed	195.0	141.0-417.0	144.0-162.0	76.0-125.0	9.0-13.0	15.34
Yellow perch	105.0	237.0-765.0	7.0-295.0	32.0-60.0	41.0-89.0	24.20
Black crappie	76.0	2.0-6.0	3.0-19.0	4.0-6.0	4.0-9.0	0.20

Based solely on electrofishing CPUE in 2001, six of the seven gamefish species listed above appear to be less abundant in Onondaga Lake, and therefore possibly provide less recreational fishing opportunity, than in almost all of the other lakes or reservoirs. The species that is the exception is smallmouth bass, whose abundance in Onondaga Lake is similar to or better than that in all of the other lakes and reservoirs except Swinging Bridge Reservoir.

NYSDEC classifies largemouth bass population densities partly based on CPUE of fish <10 inches (NYSDEC 1989). CPUE <8.0 indicates a low population density, 8.0-20.0 indicates a moderate density, and >20.0 indicates high density. The 2001 Onondaga Lake CPUE estimate for largemouth bass <10 inches long was 2.8 fish/hour in the spring and 0.32 fish/hour in the fall, indicating a low population density. The table above supports this classification, where Onondaga Lake's largemouth bass catch rates were lower than for four of the five comparison lakes.

NYSDEC (1989) also classifies smallmouth bass population densities partly based on CPUE of fish <10 inches. CPUE <1.5 indicates a low population density, 1.5-4.0 indicates a moderate density, and >4.0 indicates high-density. The 2001 Onondaga Lake catch rate of smallmouth bass <10 inches was 6.2 fish/hour in the spring and 1.4 fish/hour in the fall. This catch rate in the spring would indicate a high-density population, whereas the catch rate in the fall would indicate a low to moderate density. The high catch rate for spring is supported by the Onondaga Lake average CPUE for all smallmouth bass being higher than three of the five lakes considered by Brooking et al. (2001b).

Data from boat electrofishing surveys conducted by NYSDEC during the 1990s in Otisco Lake, one of the smaller Finger Lakes located in southwestern Onondaga County, were obtained from NYSDEC (IA and EcoLogic 2001). These surveys specifically targeted walleye, a species that has been stocked in Otisco Lake by the NYSDEC. CPUE for walleye from Otisco Lake ranged from 6.5 fish/hour (25 fish collected) in 1992 to 56.9 fish/hour (408 fish collected) in 1997. Mean CPUE for the six surveys conducted from 1992 through 1997 was 28.4 fish/hour. The Onondaga Lake walleye catch in 2001 was an average of 1.31 fish/hour, down slightly from the 1.84 in year 2000. Walleye are not being stocked into Onondaga Lake, thus accounting for the lower walleye catch rate than for Otisco Lake. However, the walleye CPUE for Onondaga Lake is similar to that recorded for Cross Lake (1.7 walleye/hour; IA and EcoLogic 2001), which also is not stocked. The limited fishing opportunity for walleye in Onondaga Lake therefore might be considered to be typical for a lake in which walleye are neither naturally propagating nor stocked yet are connected to other waterbodies where walleye are present. Both Cross and Onondaga Lakes likely receive their walleye from other connected water bodies, such as Oneida Lake, where they are either stocked or reproduce naturally.

In summary, Onondaga Lake provides recreational fishing for a wide range of gamefish species that is comparable to several lakes in New York State, but with the possible exception of smallmouth bass, the catch rate for these species presently may be lower than in many of the lakes. An angler diary program is presently underway in Onondaga Lake to determine the

recreational use of the lake by fishermen. As water quality improves and these gamefish species become better established, recreational fishing could be expected to improve as well.

5.0 LITERATURE CITED

Anderson, R. O. and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 *in*: B. R. Murphy and D. W. Willis (eds.), Fisheries Techniques, second edition. American Fisheries Society, Bethesda, MD.

Arrigo, M.A. 1998. Reproduction and recruitment of fishes in a hypereutrophic system (Onondaga Lake, New York). Master's thesis. SUNY College of Environmental Science and Forestry. Syracuse, NY.

Auer, M.T., S.W. Effler, M.L. Storey, S.D. Connors, P.Sze, C.A. Siegfried, N.A. Auer, J.D. Madsen, R.M. Smart, L.W. Eichler, C.W. Boylen, J.W. Sutherland, J.A. Bloomfield, B.A. Wagner, R. Danehey, N.A. Ringler, C. Gandino, P. Hirethota, P.Tango, M.A. Arrigo, C. Morgan, C. Millard, M. Murphy, R.J. Sloan, S.L. Niehaus, and K.A. Whitehead. 1996. Biology. In: Effler, S.W. (ed.). Limnological and Engineering Analysis of a Polluted Urban Lake: Prelude to Environmental Management of Onondaga Lake, New York. Springer-Verlag New York, Inc. 832 pp.

Backiel, T. and R.L. Welcomme (eds.). 1980. Guidelines for sampling fish in inland waters. UNFAO EIFAC Tech. Pap. (33):176 pg.

Becker, G.C. 1983. Fishes of Wisconsin. The University of Wisconsin Press.

Bister, T.J., D.W. Willis, M.L. Brown, S.M. Jordan, R.M. Neumann, M.C. Quist, and C.S. Guy. 2000. Proposed standard weight (Ws) equations and standard length categories for 18 warmwater nongame and riverine fish species. N. Amer. J. Fish. Mgt. 20:570-574.

Brooking, T. E., L. G. Rudstam, D. M. Green, F. Linhart, E. L. Mills, and M. H. Olson. 2001a. A summary of fisheries and limnology surveys of Canadarago Lake, NY: the Decade of the 1990's. Prepared by the Warmwater Fisheries Unit, Cornell University Biological Field Station, Bridgeport, NY. 10 pp. + tables and figures.

Brooking, T. E., J. R Jackson, L. G. Rudstam, and A J. Van De Valk. 2001b. Factors affecting survival of stocked walleye in New York lakes. Progress Report, 1991-2000. Prepared by the Warmwater Fisheries Unit, Cornell University Biological Field Station, Bridgeport, NY. 36 pp.

Chiotti, T. 1981. Onondaga Lake survey report. NY State Dept. Env. Cons. Region 7 report. Cortland, NY.

EcoLogic. 1999. Onondaga Lake habitat improvement project. Prepared for Onondaga County Department of Health.

Gregory, R.S. and P.M. Powles. 1988. Relative selectivity's of Miller high-speed samplers and light traps for collecting ichthyoplankton. Can. J. Fish. Aquat. Sci. 45: 993-998.

Icthyological Associates Inc. and Ecologic LLC (IA and EcoLogic). 2001. Assessment of the status of the fish community of Onondaga Lake in 2000, Onondaga Lake 2000 fish monitoring program. Report for Onondaga County Department of Drainage and Sanitation, Syracuse, NY.

Effler, S.W. (ed.). 1996. Limnological and Engineering Analysis of a Polluted Urban Lake: Prelude to Environmental Management of Onondaga Lake, New York. Springer-Verlag New York, Inc. 832 pp.

Gandino, C. J. 1996. Community structure and population characteristics of fishes in a recovering New York lake. Master's thesis. SUNY College of Environmental Science and Forestry. Syracuse, NY.

Greeley, J.R. 1928. Fishes of the Oswego watershed. In: A biological survey of the Oswego River System, Suppl. 17th Ann. Rep. NY State Cons. Dept. Albany, NY.

Karr, J.R. and D.R. Dudley. 1981. Ecological perspectives on water quality goals. Environmental Management 5:55-68.

Makarewicz, J.C., B. Cady, T. Lewis, J. Buttner, and J. Haynes. 1995. Phytoplankton, zooplankton, macrobenthos and icthyoplankton abundance biomass and species composition in Onondaga Lake, 1994. Center for Applied Aquatic Science and Aquaculture. Dept. of Biological Sciences. SUNY Brockport. Report submitted to Onondaga Lake Management office, Syracuse New York.

New York State Department of Environmental Conservation (NYSDEC). 1986. The New York State Bass Study: 1977-1980 use of angler collection data to determine population dynamics. New York State Department of Environmental Conservation. Albany, NY.

New York State Department of Environmental Conservation (NYSDEC). 1989. Centrarchid sampling manual. Chapter 1 *in*: Fish sampling manual: Guidelines for the collection, analyses and interpretation of fisheries data by units of the New York State Department of Environmental Conservation. Albany, NY.

New York State Department of Environmental Conservation (NYSDEC) 1994. Percid sampling manual. Chapter 3 *in*: Fish sampling manual: Guidelines for the collection, analyses and interpretation of fisheries data by units of the New York State Department of Environmental Conservation. Albany, NY.

Noble, R. L. and J.L. Forney.1971. Fisheries survey of Onondaga Lake. In: Onondaga Lake study, Onondaga County Water Quality Office, EPA Water Poll. Control. Res. Rep. Proj. No. 11060 FAE 4/71, 461 pp.

Ringler, N. H., C. Gandino, P. Hirethota, R. Danahey, P. Tango, M. Arrigo, C. Morgan, C. Millard, M. Murphy, R. J. Sloan, and S. W. Effler. 1996. Fish communities and habitats in Onondaga Lake, adjoining portions of the Seneca River, and lake tributaries. Chapter 6 *in*:

S. W. Effler (ed.) Limnological and engineering analyses of a polluted urban lake. Prelude to the environmental management of Onondaga Lake, New York. Springer-Verlag, NY.

Sagalkin, N. 1992. A survey of the reproductive activity of pumpkinseed and bluegill sunfish within Onondaga Lake. Unpublished manuscript. SUNY College of Environmental Science and Forestry. Syracuse, NY.

Smith, C.L. 1985. The inland fishes of New York State. New Yrok State Dept. of Env. Cons. Albany, NY.

Stone, U.B. and D. Pasko. 1946. Onondaga Lake investigation. NY State Cons. Dept. Albany, NY.

Stuber, R.J., G. Gebhart, and O.E. Maughan. 1982. Habitat sutiability index models: Bluegill. USIDI Fish and Wild. Serv. FWS/OBS-82/10.8.

Tango, P. J. 1999. Fish community ecology of a hypereutrophic urban lake. Ph.D. dissertation. SUNY College of Environmental Science and Forestry. Syracuse, NY.

Tango, P.J. and N.H. Ringler. 1996. The role of pollution and external refugia in structuring the Onondaga Lake fish community. Lake and Reservoir Management 12(1): 81-90.

Van Den Avyle, M.J. 1993. Dynamics of exploited fish populations. Pages 105 – 134 *in* C.C. Kohler and W.A. Hubert, editors. Inland fisheries management in North America. American Fisheries Society, Bethesda, Maryland.

Appendix

Appendix Table 1. Estimated pelagic Miller high-speed trawl fish density from the 2001 Onondaga Lake AMP by date, basin, and depth.

Sample date	*Basin*	*Depth (m)*	*Species*	*Density/m²*
5/16/2001	North	1		0.00
5/16/2001	North	3	Yellow perch	1.89
5/16/2001	North	5	White sucker	1.26
			Yellow perch	0.63
			Average	*0.94*
			Basin average	*1.26*
5/16/2001	South	1		0.00
5/16/2001	South	3		0.00
5/16/2001	South	5		0.00
			Basin average	*0.00*
6/13/2001	North	1	Gizzard shad	2.38
			White perch	0.40
			Average	*1.39*
6/13/2001	North	3	Gizzard shad	3.96
			White perch	0.40
			Average	*2.18*
6/13/2001	North	5	Gizzard shad	1.98
			Basin average	*3.04*
6/13/2001	South	1		0.00
6/13/2001	South	3		0.00
6/13/2001	South	5	Gizzard shad	0.30
			Basin average	*0.10*
7/12/2001	North	1		0.00
7/12/2001	North	3	Freshwater drum	0.26
			Gizzard shad	0.26
			Average	*0.26*
7/12/2001	North	5		0.00
			Basin average	*0.18*
7/12/2001	South	1	Bluegill	0.24
7/12/2001	South	3		0.00
7/12/2001	South	5		0.00
			Basin average	*0.08*

North basin average	1.30
South basin average	0.06
3 m average	1.02
1 m average	0.44
5 m average	0.38

Species	*Average CPUE*
Gizzard shad	0.49
Yellow perch	0.14
White sucker	0.07
White perch	0.04
Freshwater drum	0.01
Bluegill	0.01

Appendix Table 2. Pelagic larval light trap catch-per-unit-effort from the 2001 Onondaga Lake AMP by date, basin, and depth.

Sample date	Basin	Depth (m)	Species	Catch-per-hour
5/16/2001	North	1		0.00
5/16/2001	North	3		0.00
5/16/2001	North	5		0.00
			Basin average	*0.00*
5/16/2001	South	1		0.00
5/16/2001	South	3		0.00
5/16/2001	South	5		0.00
			Basin average	*0.00*
6/13/2001	North	1	Gizzard shad	1.14
			Yellow perch	0.86
			Average	*1.00*
6/13/2001	North	3	Carp	0.81
6/13/2001	North	5	Pumpkinseed	0.28
			Average	*0.55*
			Basin average	*1.03*
6/13/2001	South	1	Pumpkinseed	0.57
			Gizzard shad	0.29
			Average	0.43
6/13/2001	South	3	Pumpkinseed	0.28
6/13/2001	South	5		0.00
			Basin average	*0.38*
7/12/2001	North	1		0.00
7/12/2001	North	3		0.00
7/12/2001	North	5		0.00
			Basin average	*0.00*
7/12/2001	South	1		0.00
7/12/2001	South	3		0.00
7/12/2001	South	5		0.00
			Basin average	*0.00*

North basin average	0.34
South basin average	0.13
1 m average	0.29
3 m average	0.18
5 m average	0.05

Species	*Average CPUE*
Gizzard shad	0.03
Pumpkinseed	0.08
Yellow perch	0.06
Carp	0.00

Appendix Table 3. Estimated littoral larval fish catch-per-seine haul from the 2001 Onondaga Lake AMP by date, site, and species.

Sample date	*Site*	*Location*	*Species*	*CPUE*
5/17/2001	1	Nine Mile	Yellow perch	2
			White sucker	1
			Average	*1.5*
5/17/2001	2	Corn. Pt.	White sucker	1
5/17/2001	3	Metro	White sucker	5
5/17/2001	4	Marina	White sucker	4
5/17/2001	5	Willow Bay	White sucker	44
			Yellow perch	4
			Average	*24.0*
6/14/2001	1	Nine Mile	Carp	89
			Bluegill	4
			Pumpkinseed	1
			Average	*31.3*
6/14/2001	2	Corn. Pt.	Yellow perch	2
6/14/2001	3	Metro		0
6/14/2001	4	Marina	Carp	47
			Johnny darter	1
			Average	*24.0*
6/14/2001	5	Willow Bay	Carp	8
			White sucker	1
			Average	*4.5*
7/11/2001	1	Nine Mile	Brook silverside	25
			Pumpkinseed	1
			Average	*13.0*
7/11/2001	2	Corn. Pt.	Brook silverside	8
7/11/2001	3	Metro	Carp	4
			Brook silverside	2
			Golden shiner	1
			Average	*2.3*
7/11/2001	4	Marina	Carp	90
			Brook silverside	18
			Species unknown	13
			Golden shiner	1
			Average	*10.7*
7/11/2001	5	Willow Bay	Bluegill	42
			Brook silverside	4
			Average	*23.0*

Site	*Location*	*Average CPUE*	*Species*	*Average CPUE*
1	Nine Mile	41.0	Carp	15.9
5	Willow Bay	21.0	Brook silverside	3.8
3	Metro	19.3	White sucker	3.7
2	Corn. Pt.	17.9	Bluegill	3.1
4	Marina	16.1	Yellow perch	0.4
			Golden shiner	0.1
			Pumpkinseed	0.1
			Johnny darter	0.1

Appendix Table 4. Littoral larval light trap catch-per-unit-effort from the 2001 Onondaga Lake AMP by date, basin, and depth.

Sample date	*Site*	*Location*	*Species*	*Catch-per-hour*
5/17/2001	1	Nine Mile		0.00
5/17/2001	2	Corm. Pt.		0.00
5/17/2001	3	Metro		0.00
5/17/2001	4	Marina		0.00
5/17/2001	5	Willow Bay		0.00
			Date average	*0.00*
6/14/2001	1	Nine Mile	Gizzard shad	24.09
			Carp	3.86
			Pumpkinseed	1.36
			Average	*9.77*
6/14/2001	2	Corm. Pt.	Carp	0.47
			Gizzard shad	0.23
			Average	*0.35*
6/14/2001	3	Metro	Carp	0.24
6/14/2001	4	Marina	Carp	2.35
6/14/2001	5	Willow Bay	Gizzard shad	2.26
			Carp	0.90
			Largemouth bass	0.23
			Average	*1.13*
			Date average	*2.94*
7/11/2001	1	Nine Mile		0.00
7/11/2001	2	Corm. Pt.	Bluegill	0.52
7/11/2001	3	Metro		0.00
7/11/2001	4	Marina		0.00
7/11/2001	5	Willow Bay	Bluegill	1.33
			Carp	0.53
			Freshwater drum	0.27
			Average	*0.71*
			Date average	*0.38*

Site	*Location*	*Average density*
1	Nine Mile	9.77
5	Willow Bay	1.84
4	Marina	0.78
2	Corm. Pt.	0.41
3	Metro	0.08

Species	*Average density*
Gizzard shad	1.77
Carp	0.56
Bluegill	0.12
Pumpkinseed	0.09
Freshwater drum	0.02
Largemouth bass	0.02

Appendix Table 5. Species composition of the littoral larvae surveys in the 2001 Onondaga Lake AMP by gear type.

Littoral larval seines			
Site	Species	Number	Percentage of catch
1	Carp	89	72.36
1	Brook silverside	25	20.33
1	Bluegill	4	3.25
1	Pumpkinseed	2	1.63
1	Yellow perch	2	1.63
1	White sucker	1	0.81
2	Brook silverside	8	72.73
2	Yellow perch	2	18.18
2	White sucker	1	9.09
3	White sucker	5	41.67
3	Carp	4	33.33
3	Brook silverside	2	16.67
3	Golden shiner	1	8.33
4	Carp	137	85.09
4	Brook silverside	18	11.18
4	White sucker	4	2.48
4	Golden shiner	1	0.62
4	Johnny darter	1	0.62
5	White sucker	45	45.45
5	Bluegill	42	42.42
5	Carp	8	8.08
5	Brook silverside	4	4.04
5	Yellow perch	4	4.04
Whole lake	Carp	238	58.05
Whole lake	Brook silverside	57	13.90
Whole lake	White sucker	56	13.66
Whole lake	Bluegill	46	11.22
Whole lake	Yellow perch	8	1.95
Whole lake	Golden shiner	2	0.49
Whole lake	Pumpkinseed	2	0.49
Whole lake	Johnny darter	1	0.24

Littoral light traps			
Site	Species	Number	Percentage of catch
1	Gizzard shad	106	82.17
1	Carp	17	13.18
1	Pumpkinseed	6	4.65
2	Bluegill	2	40.00
2	Carp	2	40.00
2	Gizzard shad	1	20.00
3	Carp	1	
4	Carp	10	
5	Gizzard shad	10	43.48
5	Carp	6	26.09
5	Bluegill	5	21.74
5	Freshwater drum	1	4.35
5	Largemouth bass	1	4.35
Whole lake	Gizzard shad	117	69.64
Whole lake	Carp	36	21.43
Whole lake	Bluegill	7	4.17
Whole lake	Pumpkinseed	6	3.57
Whole lake	Freshwater drum	1	0.60
Whole lake	Largemouth bass	1	0.60

Appendix Table 6. Species composition of the pelagic larvae surveys in the 2001 Onondaga Lake AMP by basin, depth, and gear type.

Miller high-speed trawl				
Basin	Depth (m)	Species	Number	Percentage of catch
North	1	Gizzard shad	6	85.71
North	1	White perch	1	14.29
North	3	Freshwater drum	1	6.25
North	3	Gizzard shad	11	68.75
North	3	White perch	1	6.25
North	3	Yellow perch	3	18.75
North	5	Gizzard shad	5	62.50
North	5	White sucker	2	25.00
North	5	Yellow perch	1	12.50
South	1	Bluegill	1	
South	5	Gizzard shad	1	
North	All	Gizzard shad	22	75.86
North	All	Yellow perch	4	13.79
North	All	White perch	2	6.90
North	All	Freshwater drum	1	3.45
Whole lake		Gizzard shad	23	69.70
Whole lake		Yellow perch	4	12.12
Whole lake		White perch	2	6.06
Whole lake		White sucker	2	6.06
Whole lake		Bluegill	1	3.03
Whole lake		Freshwater drum	1	3.03

Larval light traps				
Basin	Depth (m)	Species	Number	Percentage of catch
North	1	Gizzard shad	4	57.14
North	1	Yellow perch	3	42.86
North	3	Pumpkinseed	1	
North	5	Carp	3	
South	1	Pumpkinseed	2	66.67
South	1	Gizzard shad	1	33.33
South	3	Pumpkinseed	1	
North	All	Pumpkinseed	3	75.00
North	All	Gizzard shad	4	36.36
North	All	Carp	3	27.27
North	All	Yellow perch	3	27.27
South	All	Gizzard shad	1	25.00
South	All	Pumpkinseed	1	9.09
Whole lake		Gizzard shad	5	33.33
Whole lake		Pumpkinseed	4	26.67
Whole lake		Carp	3	20.00
Whole lake		Yellow perch	3	20.00

Appendix Table 7. Mean length of fish by species from the 2001 Onondaga Lake AMP juvenile seining study.

Location			
August 2001			
Stratum 1 Site 1	YOY	Average	96.00
		SE	NA
		Samp. Sz.	1.00
Stratum 1 Site 3	YOY	Average	76.00
		SE	3.50
		Samp. Sz.	6.00
Stratum 3 Site 2	YOY	Average	70.00
		SE	8.00
		Samp. Sz.	2.00
Stratum 3 Site 3	YOY	Average	75.00
		SE	NA
		Samp. Sz.	1.00
Stratum 4 Site 1	YOY	Average	85.00
		SE	NA
		Samp. Sz.	1.00
White sucker average		Average	77.45
		SE	3.06
		Samp. Sz.	11.00
Tessellated darter			
August 2001			
Stratum 1 Site 3		Average	64.00
		SE	NA
		Samp. Sz.	1.00
September 2001			
Stratum 1 Site 1		Average	69.00
		SE	NA
		Samp. Sz.	1.00
Stratum 1 Site 2		Average	65.33
		SE	2.29
		Samp. Sz.	6.00
Stratum 1 Site 3		Average	75.00
		SE	NA
		Samp. Sz.	1.00
Stratum 4 Site 1		Average	75.00
		SE	NA
		Samp. Sz.	1.00
T. darter average		Average	67.40
		SE	1.86
		Samp. Sz.	10.00
Logperch			
August 2001			
Stratum 1 Site 1		Average	62.00
		SE	NA
		Samp. Sz.	1.00
Stratum 1 Site 3		Average	67.00
		SE	NA
		Samp. Sz.	1.00
Stratum 3 Site 1		Average	88.25
		SE	3.29
		Samp. Sz.	12.00
Stratum 3 Site 2		Average	67.80
		SE	6.08
		Samp. Sz.	5.00
Stratum 4 Site 1		Average	84.90
		SE	6.24
		Samp. Sz.	10.00
September 2001			
Stratum 1 Site 3		Average	77.80
		SE	2.46
		Samp. Sz.	5.00
Stratum 5 Site 1		Average	110.00
		SE	NA
		Samp. Sz.	1.00
Logperch average		Average	82.14
		SE	2.73
		Samp. Sz.	35.00

Location			
Brook silverside			
August 2001			
Stratum 2 Site 1		Average	57.35
		SE	3.85
		Samp. Sz.	8.00
Stratum 2 Site 2		Average	99.00
		SE	NA
		Samp. Sz.	1.00
Stratum 3 Site 2		Average	77.50
		SE	7.50
		Samp. Sz.	2.00
Stratum 3 Site 2		Average	29.17
		SE	1.92
		Samp. Sz.	24.00
September 2001			
Stratum 1 Site 3		Average	82.71
		SE	2.55
		Samp. Sz.	7.00
Stratum 3 Site 1		Average	74.33
		SE	4.70
		Samp. Sz.	3.00
Stratum 4 Site 1		Average	78.38
		SE	3.90
		Samp. Sz.	8.00
Brook silverside average		Average	53.62
		SE	3.31
		Samp. Sz.	53.00
Brook stickleback			
September 2001			
Stratum 3 Site 2		Average	88.00
		SE	NA
		Samp. Sz.	1.00
Brown bullhead			
September 2001			
Stratum 1 Site 1	YOY	Average	87.00
		SE	NA
		Samp. Sz.	1.00
Stratum 5 Site 3	YOY	Average	88.00
		SE	NA
		Samp. Sz.	1.00
B. bullhead average		Average	87.50
		SE	0.50
		Samp. Sz.	2.00
Common carp			
September 2001			
Stratum 1 Site 1	YOY	Average	120.00
		SE	NA
		Samp. Sz.	1.00
Stratum 5 Site 3	YOY	Average	140.00
		SE	NA
		Samp. Sz.	1.00
Common carp avg		Average	130.00
		SE	10.00
		Samp. Sz.	2.00
Johnny darter			
September 2001			
Stratum 1 Site 1		Average	64.00
		SE	NA
		Samp. Sz.	1.00
Tessellated darter			
September 2001			
Stratum 5 Site 1		Average	52.00
		SE	NA
		Samp. Sz.	1.00
Rock bass			
September 2001		Average	
Stratum 5 Site 1	Adult	Average	227.00
		SE	NA
		Samp. Sz.	1.00

Appendix Table 7. Continued.

[illegible] August 2001						
Stratum 1 Site 2	Average	30.00	Stratum 1 Site 1	YOY	Average	68.75
	SE	NA			SE	1.03
	Samp. Sz.	1.00			Samp. Sz.	4.00
Stratum 1 Site 3	Average	68.67	Stratum 1 Site 2	YOY	Average	80.67
	SE	6.01			SE	3.08
	Samp. Sz.	3.00			Samp. Sz.	6.00
Stratum 2 Site 1	Average	65.50	Stratum 1 Site 3	YOY	Average	75.25
	SE	5.54			SE	4.50
	Samp. Sz.	6.00			Samp. Sz.	4.00
Stratum 2 Site 2	Average	44.61	Stratum 3 Site 1	YOY	Average	67.97
	SE	2.57			SE	0.73
	Samp. Sz.	23.00			Samp. Sz.	62.00
Stratum 2 Site 3	Average	43.97	Stratum 3 Site 2	YOY	Average	66.74
	SE	1.12			SE	1.09
	Samp. Sz.	33.00			Samp. Sz.	38.00
Stratum 3 Site 2	Average	66.89	Stratum 3 Site 3	YOY	Average	65.38
	SE	3.54			SE	1.46
	Samp. Sz.	9.00			Samp. Sz.	8.00
Stratum 3 Site 3	Average	58.59	Stratum 4 Site 1	YOY	Average	69.67
	SE	1.02			SE	1.09
	Samp. Sz.	27.00			Samp. Sz.	36.00
Stratum 4 Site 1	Average	58.84	Stratum 5 Site 3	YOY	Average	67.00
	SE	1.52			SE	NA
	Samp. Sz.	25.00			Samp. Sz.	1.00
Stratum 5 Site 2	Average	36.00	**September 2001**			
	SE	2.00	Stratum 1 Site 1	YOY	Average	72.80
	Samp. Sz.	2.00			SE	2.94
Stratum 5 Site 3	Average	39.40			Samp. Sz.	5.00
	SE	2.01	Stratum 1 Site 3	YOY	Average	77.75
	Samp. Sz.	5.00			SE	1.97
September 2001					Samp. Sz.	7.00
Stratum 1 Site 3	Average	62.50	Stratum 2 Site 2	YOY	Average	94.00
	SE	1.77			SE	NA
	Samp. Sz.	20.00			Samp. Sz.	1.00
Stratum 2 Site 1	Average	58.65	Stratum 2 Site 3	YOY	Average	92.00
	SE	1.16			SE	2.00
	Samp. Sz.	31.00			Samp. Sz.	2.00
Stratum 2 Site 2	Average	55.06	Stratum 3 Site 2	YOY	Average	80.28
	SE	1.02			SE	1.59
	Samp. Sz.	50.00			Samp. Sz.	18.00
Stratum 2 Site 3	Average	55.57	Stratum 4 Site 3	YOY	Average	74.00
	SE	0.85			SE	4.00
	Samp. Sz.	15.00			Samp. Sz.	2.00
Stratum 3 Site 1	Average	66.07	Stratum 5 Site 3	YOY	Average	67.00
	SE	1.26			SE	5.00
	Samp. Sz.	43.00			Samp. Sz.	2.00
Stratum 3 Site 2	Average	58.25	Stratum 5 Site 3	Adult	Average	189.00
	SE	1.85			SE	NA
	Samp. Sz.	8.00			Samp. Sz.	1.00
Stratum 3 Site 3	Average	61.88	Yellow perch average		Average	70.77
	SE	1.99			SE	0.58
	Samp. Sz.	8.00			Samp. Sz.	156.00
Stratum 4 Site 1	Average	61.90	**White perch August 2001**			
	SE	1.11	Stratum 1 Site 1	YOY	Average	54.95
	Samp. Sz.	20.00			SE	1.46
Stratum 4 Site 2	Average	60.00			Samp. Sz.	22.00
	SE	NA	Stratum 1 Site 2	YOY	Average	50.33
	Samp. Sz.	1.00			SE	1.45
Stratum 4 Site 3	Average	59.21			Samp. Sz.	3.00
	SE	1.03	Stratum 4 Site 1	YOY	Average	50.67
	Samp. Sz.	39.00			SE	1.25
Stratum 5 Site 1	Average	66.50			Samp. Sz.	9.00
	SE	1.95	**September 2001**			
	Samp. Sz.	6.00	Stratum 2 Site 3	YOY	Average	132.00
Stratum 5 Site 2	Average	61.50			SE	NA
	SE	0.50			Samp. Sz.	1.00
	Samp. Sz.	2.00	Stratum 5 Site 3	YOY	Average	147.50
Stratum 5 Site 3	Average	58.77			SE	2.50
	SE	1.20			Samp. Sz.	2.00
	Samp. Sz.	47.00				
Banded killifish average	Average	57.41	White perch average		Average	61.43
	SE	0.43			SE	4.15
	Samp. Sz.	444.00			Samp. Sz.	5.00

Appendix Table 7. Continued.

[redacted]			
August 2001			
Stratum 3 Site 1		Average	48.00
		SE	1.50
		Samp. Sz.	2.00
Stratum 3 Site 2		Average	97.00
		SE	NA
		Samp. Sz.	1.00
Stratum 3 Site 3		Average	58.50
		SE	3.50
		Samp. Sz.	2.00
Stratum 4 Site 1		Average	60.33
		SE	3.33
		Samp. Sz.	3.00
September 2001			
Stratum 1 Site 1		Average	71.00
		SE	NA
		Samp. Sz.	1.00
Stratum 3 Site 1		Average	70.00
		SE	NA
		Samp. Sz.	1.00
Stratum 4 Site 3		Average	61.00
		SE	NA
		Samp. Sz.	1.00
Bluntnose minnow average		Average	69.64
		SE	2.28
		Samp. Sz.	11.00
[redacted]			
August 2001			
Stratum 1 Site 1	Adult	Average	176.00
		SE	NA
		Samp. Sz.	1.00
Stratum 1 Site 2	Adult	Average	162.00
		SE	NA
		Samp. Sz.	1.00
Stratum 3 Site 1	Adult	Average	158.50
		SE	0.50
		Samp. Sz.	2.00
September 2001			
Stratum 1 Site 2	YOY	Average	69.00
		SE	NA
		Samp. Sz.	1.00
Stratum 3 Site 2	YOY	Average	50.33
		SE	3.10
		Samp. Sz.	15.00
Stratum 4 Site 2	YOY	Average	57.67
		SE	1.20
		Samp. Sz.	3.00
Stratum 4 Site 3	YOY	Average	60.50
		SE	2.50
		Samp. Sz.	2.00
Stratum 5 Site 1	YOY	Average	60.00
		SE	2.00
		Samp. Sz.	2.00
YOY Bluegill average		Average	50.43
		SE	2.21
		Samp. Sz.	20.00

[redacted]			
[redacted]			
Stratum 1 Site 2		Average	55.00
		SE	1.52
		Samp. Sz.	5.00
Stratum 3 Site 1		Average	80.90
		SE	1.85
		Samp. Sz.	10.00
September 2001			
Stratum 4 Site 2		Average	89.00
		SE	NA
		Samp. Sz.	1.00
Emerald shiner average		Average	77.58
		SE	1.83
		Samp. Sz.	16.00
[redacted]			
August 2001			
Stratum 2 Site 1	YOY	Average	69.00
		SE	1.17
		Samp. Sz.	29.00
Stratum 3 Site 1	YOY	Average	51.17
		SE	1.32
		Samp. Sz.	30.00
Stratum 3 Site 2	YOY	Average	51.33
		SE	2.89
		Samp. Sz.	3.00
Stratum 4 Site 1	YOY	Average	62.00
		SE	NA
		Samp. Sz.	1.00
Stratum 4 Site 3	YOY	Average	97.00
		SE	NA
		Samp. Sz.	1.00
September 2001			
Stratum 2 Site 3	YOY	Average	165.75
		SE	2.50
		Samp. Sz.	4.00
Stratum 4 Site 3	YOY	Average	120.00
		SE	NA
		Samp. Sz.	1.00
Gizzard shad average		Average	65.83
		SE	2.40
		Samp. Sz.	69.00
[redacted]			
August 2001			
Stratum 3 Site 1	YOY	Average	65.00
		SE	2.98
		Samp. Sz.	7.00
Stratum 4 Site 1	YOY	Average	71.00
		SE	NA
		Samp. Sz.	1.00
September 2001			
Stratum 1 Site 1	YOY	Average	74.83
		SE	1.45
		Samp. Sz.	2.00
Stratum 1 Site 2	YOY	Average	68.00
		SE	NA
		Samp. Sz.	1.00
Stratum 1 Site 2	YOY	Average	70.00
		SE	NA
		Samp. Sz.	1.00
Stratum 2 Site 2	YOY	Average	80.00
		SE	NA
		Samp. Sz.	1.00
Stratum 2 Site 3	YOY	Average	91.00
		SE	NA
		Samp. Sz.	1.00
Stratum 3 Site 1	YOY	Average	70.00
		SE	NA
		Samp. Sz.	1.00
Stratum 3 Site 2	YOY	Average	71.33
		SE	4.63
		Samp. Sz.	3.00
Stratum 4 Site 2	YOY	Average	75.50
		SE	0.50
		Samp. Sz.	2.00
Stratum 4 Site 3	YOY	Average	72.50
		SE	2.31
		Samp. Sz.	11.00
Stratum 5 Site 3	YOY	Average	68.00
		SE	NA
		Samp. Sz.	1.00
Golden shiner average		Average	71.32
		SE	1.34
		Samp. Sz.	30.00

Appendix Table 7. Continued.

Stratum 1 Site 1	YOY	Average	76.48
		SE	2.10
		Samp. Sz.	50.00
Stratum 1 Site 2	YOY	Average	74.83
		SE	4.77
		Samp. Sz.	6.00
Stratum 1 Site 3	YOY	Average	70.25
		SE	4.95
		Samp. Sz.	8.00
Stratum 2 Site 1	YOY	Average	82.50
		SE	8.50
		Samp. Sz.	2.00
Stratum 2 Site 2	YOY	Average	79.25
		SE	2.39
		Samp. Sz.	4.00
Stratum 2 Site 3	YOY	Average	67.80
		SE	4.81
		Samp. Sz.	5.00
Stratum 3 Site 1	YOY	Average	87.00
		SE	NA
		Samp. Sz.	1.00
Stratum 3 Site 2	YOY	Average	79.52
		SE	1.96
		Samp. Sz.	23.00
Stratum 3 Site 3	YOY	Average	76.59
		SE	1.56
		Samp. Sz.	39.00
Stratum 4 Site 1	YOY	Average	79.52
		SE	2.86
		Samp. Sz.	23.00
Stratum 4 Site 2	YOY	Average	81.70
		SE	3.22
		Samp. Sz.	10.00
Stratum 4 Site 3	YOY	Average	79.55
		SE	2.97
		Samp. Sz.	20.00
Stratum 5 Site 1	YOY	Average	73.10
		SE	2.40
		Samp. Sz.	10.00
Stratum 5 Site 2	YOY	Average	52.00
		SE	NA
		Samp. Sz.	1.00
Stratum 5 Site 3	YOY	Average	55.63
		SE	2.05
		Samp. Sz.	8.00
September 2001			
Stratum 1 Site 1	YOY	Average	101.70
		SE	3.54
		Samp. Sz.	10.00
Stratum 1 Site 2	YOY	Average	107.25
		SE	6.82
		Samp. Sz.	4.00
Stratum 1 Site 3	YOY	Average	78.00
		SE	2.36
		Samp. Sz.	5.00
Stratum 2 Site 1	YOY	Average	92.60
		SE	2.93
		Samp. Sz.	5.00
Stratum 2 Site 2	YOY	Average	102.50
		SE	4.50
		Samp. Sz.	2.00
Stratum 2 Site 3	YOY	Average	92.67
		SE	8.01
		Samp. Sz.	3.00
Stratum 4 Site 1	YOY	Average	138.00
		SE	NA
		Samp. Sz.	1.00
Stratum 4 Site 2	YOY	Average	113.67
		SE	6.23
		Samp. Sz.	3.00
Stratum 4 Site 3	YOY	Average	103.00
		SE	9.50
		Samp. Sz.	2.00
Stratum 5 Site 1	YOY	Average	97.40
		SE	4.93
		Samp. Sz.	5.00
Stratum 5 Site 2	YOY	Average	100.50
		SE	8.25
		Samp. Sz.	4.00
Stratum 5 Site 3	YOY	Average	104.00
		SE	NA
		Samp. Sz.	1.00
Largemouth bass average		Average	78.85
		SE	1.04
		Samp. Sz.	256.00

Stratum 1 Site 1	YOY	Average	49.93
		SE	0.35
		Samp. Sz.	32.00
Stratum 1 Site 2	YOY	Average	36.75
		SE	1.44
		Samp. Sz.	60.00
Stratum 1 Site 3	YOY	Average	42.17
		SE	0.66
		Samp. Sz.	60.00
Stratum 2 Site 1	YOY	Average	42.67
		SE	1.45
		Samp. Sz.	6.00
Stratum 2 Site 2	YOY	Average	37.13
		SE	1.09
		Samp. Sz.	15.00
Stratum 2 Site 3	YOY	Average	38.20
		SE	1.20
		Samp. Sz.	23.00
Stratum 3 Site 1	YOY	Average	58.83
		SE	0.98
		Samp. Sz.	65.00
Stratum 3 Site 2	YOY	Average	47.57
		SE	0.60
		Samp. Sz.	62.00
Stratum 3 Site 3	YOY	Average	45.50
		SE	0.58
		Samp. Sz.	60.00
Stratum 4 Site 1	YOY	Average	42.15
		SE	0.80
		Samp. Sz.	87.00
Stratum 4 Site 3	YOY	Average	41.64
		SE	0.56
		Samp. Sz.	58.00
Stratum 5 Site 1	YOY	Average	36.96
		SE	0.80
		Samp. Sz.	45.00
Stratum 5 Site 2	YOY	Average	42.71
		SE	2.45
		Samp. Sz.	7.00
Stratum 5 Site 3	YOY	Average	41.67
		SE	0.74
		Samp. Sz.	51.00
September 2001			
Stratum 1 Site 1	YOY	Average	49.88
		SE	0.30
		Samp. Sz.	41.00
Stratum 1 Site 2	YOY	Average	48.56
		SE	0.78
		Samp. Sz.	58.00
Stratum 1 Site 3	YOY	Average	42.42
		SE	1.05
		Samp. Sz.	46.00
Stratum 2 Site 2	YOY	Average	45.17
		SE	3.02
		Samp. Sz.	6.00
Stratum 2 Site 3	YOY	Average	38.17
		SE	1.96
		Samp. Sz.	6.00
Stratum 3 Site 1	YOY	Average	49.58
		SE	1.18
		Samp. Sz.	38.00
Stratum 3 Site 2	YOY	Average	47.88
		SE	1.19
		Samp. Sz.	17.00
Stratum 3 Site 3	YOY	Average	46.77
		SE	1.01
		Samp. Sz.	38.00
Stratum 4 Site 1	YOY	Average	45.34
		SE	1.01
		Samp. Sz.	29.00
Stratum 4 Site 2	YOY	Average	45.64
		SE	0.67
		Samp. Sz.	95.00
Stratum 4 Site 3	YOY	Average	45.89
		SE	0.77
		Samp. Sz.	59.00
Stratum 5 Site 1	YOY	Average	40.94
		SE	0.96
		Samp. Sz.	76.00
Stratum 5 Site 2	YOY	Average	44.19
		SE	0.72
		Samp. Sz.	52.00
Stratum 5 Site 3	YOY	Average	46.15
		SE	0.77
		Samp. Sz.	62.00
Largemouth bass		Average	45.50
		SE	0.20
		Samp. Sz.	1207.00

Appendix Table 7. Continued.

Location	Life stage		
Stratum 1 Site 1	Adult	Average	122.33
		SE	7.88
		Samp. Sz.	3.00
Stratum 1 Site 1	YOY	Average	57.40
		SE	4.12
		Samp. Sz.	5.00
Stratum 1 Site 2	Adult	Average	135.00
		SE	5.00
		Samp. Sz.	2.00
Stratum 3 Site 1	YOY	Average	86.00
		SE	4.00
		Samp. Sz.	2.00
Stratum 3 Site 2	YOY	Average	96.00
		SE	NA
		Samp. Sz.	1.00
Stratum 4 Site 2	YOY	Average	56.00
		SE	NA
		Samp. Sz.	1.00
Stratum 4 Site 3	YOY	Average	69.00
		SE	11.00
		Samp. Sz.	2.00
Stratum 4 Site 3	Adult	Average	134.00
		SE	NA
		Samp. Sz.	1.00
Stratum 5 Site 1	Adult	Average	139.78
		SE	1.64
		Samp. Sz.	18.00
Stratum 5 Site 2	Adult	Average	143.50
		SE	1.50
		Samp. Sz.	2.00
September 2001			
Stratum 1 Site 1	YOY	Average	73.00
		SE	NA
		Samp. Sz.	1.00
Stratum 1 Site 1	Adult	Average	141.00
		SE	NA
		Samp. Sz.	1.00
Stratum 1 Site 2	YOY	Average	60.00
		SE	2.00
		Samp. Sz.	2.00
Stratum 1 Site 2	Adult	Average	156.00
		SE	NA
		Samp. Sz.	1.00
Stratum 1 Site 3	YOY	Average	59.33
		SE	2.40
		Samp. Sz.	3.00
Stratum 3 Site 1	YOY	Average	59.00
		SE	1.00
		Samp. Sz.	2.00
Stratum 3 Site 2	YOY	Average	53.78
		SE	0.83
		Samp. Sz.	18.00
Stratum 4 Site 2	YOY	Average	64.75
		SE	2.50
		Samp. Sz.	4.00
Stratum 4 Site 3	YOY	Average	61.91
		SE	0.92
		Samp. Sz.	11.00
Stratum 5 Site 1	YOY	Average	69.00
		SE	3.54
		Samp. Sz.	6.00
Stratum 5 Site 2	YOY	Average	75.67
		SE	9.74
		Samp. Sz.	3.00
YOY Pumpkinseed avg.		Average	61.24
		SE	1.35
		Samp. Sz.	48.00

Location	Life stage		
Stratum 1 Site 1	YOY	Average	58.00
		SE	1.47
		Samp. Sz.	4.00
Stratum 1 Site 2	YOY	Average	57.33
		SE	4.10
		Samp. Sz.	3.00
Stratum 1 Site 3	YOY	Average	161.00
		SE	NA
		Samp. Sz.	1.00
Stratum 2 Site 2	YOY	Average	67.00
		SE	4.36
		Samp. Sz.	3.00
Stratum 2 Site 3	YOY	Average	70.56
		SE	2.02
		Samp. Sz.	9.00
Stratum 3 Site 2	YOY	Average	77.62
		SE	1.68
		Samp. Sz.	47.00
Stratum 3 Site 3	YOY	Average	59.00
		SE	6.00
		Samp. Sz.	2.00
Stratum 4 Site 1	YOY	Average	65.64
		SE	1.13
		Samp. Sz.	39.00
Stratum 4 Site 2	YOY	Average	70.00
		SE	8.00
		Samp. Sz.	2.00
Stratum 5 Site 1	YOY	Average	69.73
		SE	2.86
		Samp. Sz.	15.00
Stratum 5 Site 2	YOY	Average	66.15
		SE	1.41
		Samp. Sz.	23.00
Stratum 5 Site 3	YOY	Average	61.75
		SE	2.41
		Samp. Sz.	20.00
September 2001			
Stratum 1 Site 1	YOY	Average	78.50
		SE	4.50
		Samp. Sz.	2.00
Stratum 2 Site 3	YOY	Average	91.00
		SE	NA
		Samp. Sz.	1.00
Stratum 3 Site 2	YOY	Average	95.00
		SE	7.50
		Samp. Sz.	4.00
Stratum 4 Site 1	YOY	Average	113.00
		SE	NA
		Samp. Sz.	1.00
Stratum 4 Site 2	YOY	Average	92.00
		SE	NA
		Samp. Sz.	1.00
Stratum 4 Site 3	YOY	Average	89.00
		SE	NA
		Samp. Sz.	1.00
Stratum 5 Site 1	YOY	Average	93.50
		SE	2.93
		Samp. Sz.	8.00
Stratum 5 Site 2	YOY	Average	88.11
		SE	2.08
		Samp. Sz.	9.00
Stratum 5 Site 3	YOY	Average	104.00
		SE	NA
		Samp. Sz.	1.00
Smallmouth bass average		Average	72.63
		SE	1.06
		Samp. Sz.	196.00

Appendix Table 8. Instantaneous growth rate of YOY fish species sampled in the 2001 Onondaga County AMP juvenile seine survey by location.

Species	Location	Instantaneous growth rate
Tessellated darter	Stratum 1 Site 3	0.021
	Whole lake	0.041
Banded killifish	Stratum 2 Site 2	0.182
	Stratum 5 Site 2	0.536
	Whole lake	0.378
Yellow perch	Stratum 1 Site 1	0.112
	Stratum 1 Site 3	-0.040
	Stratum 3 Site 2	0.185
	Stratum 5 Site 3	0.000
	Stratum 1 avg.	0.036
	Whole lake	0.124
White perch	Whole lake	0.981
Bluntnose minnow	Whole lake	0.155
Gizzard shad	Stratum 4 Site 3	0.213
	Whole lake	0.780
Largemouth bass	Stratum 1 Site 1	0.295
	Stratum 1 Site 2	0.360
	Stratum 1 Site 3	0.105
	Stratum 3 Site 1	0.040
	Stratum 3 Site 2	0.374
	Stratum 3 Site 3	0.191
	Stratum 4 Site 1	0.671
	Stratum 4 Site 2	0.365
	Stratum 4 Site 3	0.241
	Stratum 5 Site 1	0.287
	Stratum 5 Site 2	0.659
	Stratum 5 Site 3	0.626
	Stratum 1 avg.	0.253
	Stratum 3 avg.	0.201
	Stratum 4 avg.	0.426
	Stratum 5 avg.	0.524
	Whole lake	0.339

Species	Location	Instantaneous growth rate
Lepomis sp.	Stratum 1 Site 1	-0.117
	Stratum 1 Site 2	0.292
	Stratum 1 Site 3	0.007
	Stratum 2 Site 2	0.196
	Stratum 2 Site 3	-0.004
	Stratum 3 Site 1	0.184
	Stratum 3 Site 2	0.113
	Stratum 3 Site 3	0.150
	Stratum 4 Site 1	0.074
	Stratum 4 Site 3	0.138
	Stratum 5 Site 1	0.293
	Stratum 5 Site 2	0.034
	Stratum 5 Site 3	0.099
	Whole lake	0.107
	Stratum 1 avg.	0.061
	Stratum 2 avg.	0.096
	Stratum 3 avg.	0.149
	Stratum 4 avg.	0.106
	Stratum 5 avg.	0.142
Pumpkinseed	Stratum 1 Site 1	0.240
	Stratum 4 Site 2	0.145
	Stratum 4 Site 3	0.065
	Stratum 4 avg.	0.105
	Whole lake	0.087
Smallmouth bass	Stratum 1 Site 1	0.303
	Stratum 2 Site 3	0.254
	Stratum 3 Site 2	0.202
	Stratum 4 Site 1	0.543
	Stratum 4 Site 2	0.273
	Stratum 5 Site 1	0.293
	Stratum 5 Site 2	0.287
	Stratum 5 Site 3	0.521
	Stratum 4 avg.	0.408
	Stratum 5 avg.	0.367
	Whole lake	0.356

Appendix Table 9. Community structure of the 2001 Onondaga Lake AMP juvenile seine catches by location.

Location	Number of fish	Species name	Species composition
Stratum 1 Site 1	2	Bluegill	0.49%
	1	Bluntnose minnow	0.24%
	1	Brown bullhead	0.24%
	1	Common carp	0.24%
	3	Golden shiner	0.73%
	1	Johnny darter	0.24%
	60	Largemouth bass	14.56%
	315	Lepomis sp.	76.46%
	1	Logperch	0.24%
	10	Pumpkinseed	2.43%
	6	Smallmouth bass	1.46%
	1	Tessellated darter	0.24%
	1	White sucker	0.24%
	9	Yellow perch	2.18%
Total	412		100.00%
Stratum 1 Site 2	1	Banded killifish	0.22%
	1	Bluegill	0.22%
	4	Emerald shiner	0.88%
	2	Golden shiner	0.44%
	10	Largemouth bass	2.19%
	425	Lepomis sp.	93.00%
	5	Pumpkinseed	1.09%
	3	Smallmouth bass	0.66%
	6	Yellow perch	1.31%
Total	457		100.00%
Stratum 1 Site 3	23	Banded killifish	3.20%
	7	Brook silverside	0.97%
	13	Largemouth bass	1.81%
	648	Lepomis sp.	90.13%
	6	Logperch	0.83%
	3	Pumpkinseed	0.42%
	1	Smallmouth bass	0.14%
	8	Tessellated darter	1.11%
	4	White sucker	0.56%
	6	Yellow perch	0.83%
Total	719		100.00%
Stratum 2 Site 1	37	Banded killifish	6.69%
	8	Brook silverside	1.45%
	500	Gizzard shad	90.42%
	2	Largemouth bass	0.36%
	6	Lepomis sp.	1.08%
Total	553		100.00%
Stratum 2 Site 2	73	Banded killifish	70.19%
	1	Brook silverside	0.96%
	1	Golden shiner	0.96%
	4	Largemouth bass	3.85%
	21	Lepomis sp.	20.19%
	3	Smallmouth bass	2.88%
	1	Yellow perch	0.96%
Total	104		100.00%
Stratum 2 Site 3	151	Banded killifish	74.38%
	4	Gizzard shad	1.97%
	1	Golden shiner	0.49%
	5	Largemouth bass	2.46%
	29	Lepomis sp.	14.29%
	10	Smallmouth bass	4.93%
	1	White perch	0.49%
	2	Yellow perch	0.99%
Total	203		100.00%
Stratum 3 Site 1	43	Banded killifish	2.57%
	3	Bluntnose minnow	0.18%
	3	Brook silverside	0.18%
	33	Emerald shiner	1.97%
	1053	Gizzard shad	62.94%
	9	Golden shiner	0.54%
	6	Largemouth bass	0.36%
	289	Lepomis sp.	17.27%
	12	Logperch	0.72%
	1	Longnose dace	0.06%
	2	Pumpkinseed	0.12%
	22	White perch	1.32%
	197	Yellow perch	11.78%
Total	1673		100.00%
Stratum 3 Site 2	17	Banded killifish	2.70%
	15	Bluegill	2.38%
	1	Bluntnose minnow	0.16%
	2	Brook silverside	0.32%
	3	Gizzard shad	0.48%
	3	Golden shiner	0.48%
	25	Largemouth bass	3.97%
	429	Lepomis sp.	68.10%
	5	Logperch	0.79%
	19	Pumpkinseed	3.02%
	51	Smallmouth bass	8.10%
	3	White perch	0.48%
	2	White sucker	0.32%
	55	Yellow perch	8.73%
Total	630		100.00%
Stratum 3 Site 3	35	Banded killifish	3.13%
	2	Bluntnose minnow	0.18%
	42	Largemouth bass	3.76%
	1027	Lepomis sp.	91.94%
	2	Smallmouth bass	0.18%
	1	White sucker	0.09%
	8	Yellow perch	0.72%
Total	1117		100.00%
Stratum 4 Site 1	45	Banded killifish	3.45%
	1	Bluntnose minnow	0.08%
	5	Brook silverside	0.38%
	1	Gizzard shad	0.08%
	1	Golden shiner	0.08%
	24	Largemouth bass	1.84%
	1129	Lepomis sp.	86.65%
	10	Logperch	0.77%
	40	Smallmouth bass	3.07%
	1	Tessellated darter	0.08%
	9	White perch	0.69%
	1	White sucker	0.08%
	36	Yellow perch	2.76%
Total	1303		100.00%

Appendix Table 9. Continued.

Location	Number of fish	Species name	Species composition
Stratum 4 Site 2	1	Banded killifish	0.76%
	1	Emerald shiner	0.76%
	2	Golden shiner	1.53%
	13	Largemouth bass	9.92%
	107	Lepomis sp.	81.68%
	4	Pumpkinseed	3.05%
	3	Smallmouth bass	2.29%
Total	131		100.00%
Stratum 4 Site 3	37	Banded killifish	6.08%
	2	Bluegill	0.33%
	1	Bluntnose minnow	0.16%
	2	Gizzard shad	0.33%
	11	Golden shiner	1.81%
	23	Largemouth bass	3.78%
	516	Lepomis sp.	84.73%
	14	Pumpkinseed	2.30%
	1	Smallmouth bass	0.16%
	2	Yellow perch	0.33%
Total	609		100.00%
Stratum 5 Site 1	6	Banded killifish	2.05%
	4	Bluegill	1.37%
	15	Largemouth bass	5.14%
	220	Lepomis sp.	75.34%
	1	Logperch	0.34%
	22	Pumpkinseed	7.53%
	1	Rock bass	0.34%
	23	Smallmouth bass	7.88%
Total	292		100.00%
Stratum 5 Site 2	9	Banded killifish	3.88%
	24	Brook silverside	10.34%
	1	Brook stickleback	0.43%
	5	Largemouth bass	2.16%
	156	Lepomis sp.	67.24%
	5	Pumpkinseed	2.16%
	32	Smallmouth bass	13.79%
Total	232		100.00%
Stratum 5 Site 3	58	Banded killifish	17.63%
	1	Brown bullhead	0.30%
	1	Common carp	0.30%
	1	Golden shiner	0.30%
	9	Largemouth bass	2.74%
	232	Lepomis sp.	70.52%
	21	Smallmouth bass	6.38%
	2	White perch	0.61%
	4	Yellow perch	1.22%
Total	329		100.00%

Whole lake species composition values summed spatially and temporally

Species name	Number of fish	Species composition
Banded killifish	536	6.11
Bluegill	24	0.27
Bluntnose minnow	9	0.10
Brook silverside	50	0.57
Brook stickleback	1	0.01
Brown bullhead	2	0.02
Common carp	2	0.02
Emerald shiner	38	0.43
Gizzard shad	1563	17.82
Golden shiner	34	0.39
Johnny darter	1	0.01
Largemouth bass	256	2.92
Lepomis sp.	5549	63.26
Logperch	35	0.40
Longnose dace	1	0.01
Pumpkinseed	84	0.96
Rock bass	1	0.01
Smallmouth bass	196	2.23
Tessellated darter	10	0.11
White perch	37	0.42
White sucker	9	0.10
Yellow perch	334	3.81
Total	8772	100.00

Appendix Table 10. Catch-per-unit effort by location and month of the 2001 Onondaga Lake AMP juvenile seine study.

August juvenile seine			
Location	Life Stage	Number of fish	Species name
Stratum 1 Site 1	Adult	1.0	Bluegill
	Avg. CPUE	0.5	
Stratum 1 Site 1	YOY	1.0	White sucker
	Avg. CPUE	0.5	
Stratum 1 Site 1	YOY	50.0	Largemouth bass
	Avg. CPUE	25.0	
Stratum 1 Site 1	YOY	33.0	Lepomis sp.
	Avg. CPUE	16.5	
Stratum 1 Site 1	Adult	1.0	Logperch
	Avg. CPUE	0.5	
Stratum 1 Site 1	YOY	5.0	Pumpkinseed
	Avg. CPUE	2.5	
	Adult	3.0	Pumpkinseed
	Avg. CPUE	1.5	
	Comb. Avg.	4.0	
Stratum 1 Site 1	YOY	4.0	Smallmouth bass
	Avg. CPUE	2.0	
Stratum 1 Site 1	YOY	4.0	Yellow perch
	Avg. CPUE	2.0	
Stratum 1 Site 2	Adult	1.0	Banded killifish
	Avg. CPUE	0.5	
Stratum 1 Site 2	Adult	1.0	Bluegill
	Avg. CPUE	0.5	
Stratum 1 Site 2	Adult	4.0	Emerald shiner
	Avg. CPUE	2.0	
Stratum 1 Site 2	YOY	6.0	Largemouth bass
	Avg. CPUE	3.0	
Stratum 1 Site 2	YOY	362.0	Lepomis sp.
	Avg. CPUE	181.0	
Stratum 1 Site 2	Adult	2.0	Pumpkinseed
	Avg. CPUE	1.0	
Stratum 1 Site 2	YOY	3.0	Smallmouth bass
	Avg. CPUE	1.5	
Stratum 1 Site 2	YOY	6.0	Yellow perch
	Avg. CPUE	3.0	
Stratum 1 Site 3	Adult	3.0	Banded killifish
	Avg. CPUE	1.5	
Stratum 1 Site 3	YOY	8.0	Largemouth bass
	Avg. CPUE	4.0	
Stratum 1 Site 3	YOY	381.0	Lepomis sp.
	Avg. CPUE	190.5	
Stratum 1 Site 3	YOY	1.0	Logperch
	Avg. CPUE	0.5	
Stratum 1 Site 3	Juv.	1.0	Smallmouth bass
	Avg. CPUE	0.5	
Stratum 1 Site 3	YOY	1.0	Tessellated darter
	Avg. CPUE	0.5	
Stratum 1 Site 3	YOY	4.0	White sucker
	Avg. CPUE	2.0	
Stratum 1 Site 3	YOY	4.0	Yellow perch
	Avg. CPUE	2.0	
Stratum 2 Site 1	Adult	6.0	Banded killifish
	Avg. CPUE	3.0	
Stratum 2 Site 1	Adult	8.0	Brook silverside
	Avg. CPUE	4.0	
Stratum 2 Site 1	YOY	500.0	Gizzard shad
	Avg. CPUE	250.0	
Stratum 2 Site 1	YOY	2.0	Largemouth bass
	Avg. CPUE	1.0	

September juvenile seine			
Location	Life Stage	Number of fish	Species name
Stratum 1 Site 1	YOY	1.0	Bluegill
	Avg. CPUE	0.5	
Stratum 1 Site 1	Juv.	1.0	Bluntnose minnow
	Avg. CPUE	0.5	
Stratum 1 Site 1	YOY	1.0	Brown bullhead
	Avg. CPUE	0.5	
Stratum 1 Site 1	YOY	1.0	Common carp
	Avg. CPUE	0.5	
Stratum 1 Site 1	YOY	1.0	Johnny darter
	Avg. CPUE	0.5	
Stratum 1 Site 1	YOY	3.0	Golden shiner
	Avg. CPUE	1.5	
Stratum 1 Site 1	YOY	10.0	Largemouth bass
	Avg. CPUE	5.0	
Stratum 1 Site 1	YOY	282.0	Lepomis sp.
	Avg. CPUE	141.0	
Stratum 1 Site 1	YOY	1.0	Pumpkinseed
	Avg. CPUE	0.5	
	Adult	1.0	Pumpkinseed
	Avg. CPUE	0.5	
	Comb. Avg.	1.0	
Stratum 1 Site 1	YOY	2.0	Smallmouth bass
	Avg. CPUE	1.0	
Stratum 1 Site 1	YOY	1.0	Tessellated darter
	Avg. CPUE	0.5	
Stratum 1 Site 1	YOY	5.0	Yellow perch
	Avg. CPUE	2.5	
Stratum 1 Site 2	YOY	1.0	Golden shiner
	Avg. CPUE	0.5	
	Adult	1.0	Golden shiner
	Avg. CPUE	0.5	
	Comb. Avg.	1.0	
Stratum 1 Site 2	YOY	4.0	Largemouth bass
	Avg. CPUE	2.0	
Stratum 1 Site 2	YOY	63.0	Lepomis sp.
	Avg. CPUE	31.5	
Stratum 1 Site 2	YOY	2.0	Pumpkinseed
	Avg. CPUE	1.0	
	Adult	1.0	Pumpkinseed
	Avg. CPUE	0.5	
	Comb. Avg.	1.5	
Stratum 1 Site 3	YOY	6.0	Banded killifish
	Avg. CPUE	3.0	
	Adult	14.0	Banded killifish
	Avg. CPUE	7.0	
	Comb. Avg.	10.0	
Stratum 1 Site 3	Adult	7.0	Brook silverside
	Avg. CPUE	3.5	
Stratum 1 Site 3	YOY	5.0	Largemouth bass
	Avg. CPUE	2.5	
Stratum 1 Site 3	YOY	267.0	Lepomis sp.
	Avg. CPUE	133.5	
Stratum 1 Site 3	Adult	5.0	Logperch
	Avg. CPUE	2.5	
Stratum 1 Site 3	YOY	3.0	Pumpkinseed
	Avg. CPUE	1.5	

Appendix Table 10. Continued.

August juvenile seining				September juvenile seining			
Location	Life Stage	Number of fish	Species name	Location	Life Stage	Number of fish	Species name
Stratum 4 Site 3	YOY	1.0	Gizzard shad	Stratum 4 Site 3	YOY	135.0	Lepomis sp.
	Avg. CPUE	0.5			Avg. CPUE	67.5	
Stratum 4 Site 3	YOY	20.0	Largemouth bass	Stratum 4 Site 3	YOY	11.0	Pumpkinseed
	Avg. CPUE	10.0			Avg. CPUE	5.5	
Stratum 4 Site 3	YOY	381.0	Lepomis sp.	Stratum 4 Site 3	YOY	1.0	Smallmouth bass
	Avg. CPUE	190.5			Avg. CPUE	0.5	
Stratum 4 Site 3	YOY	2.0	Pumpkinseed	Stratum 4 Site 3	YOY	2.0	Yellow perch
	Avg. CPUE	1.0			Avg. CPUE	1.0	
	Adult	1.0	Pumpkinseed	Stratum 5 Site 1	Adult	6.0	Banded killifish
	Avg. CPUE	0.5			Avg. CPUE	3.0	
	Comb. Avg.	1.5		Stratum 5 Site 1	YOY	2.0	Bluegill
Stratum 5 Site 1	Adult	2.0	Bluegill		Avg. CPUE	1.0	
	Avg. CPUE	1.0		Stratum 5 Site 1	YOY	5.0	Largemouth bass
Stratum 5 Site 1	YOY	10.0	Largemouth bass		Avg. CPUE	2.5	
	Avg. CPUE	5.0		Stratum 5 Site 1	YOY	175.0	Lepomis sp.
Stratum 5 Site 1	YOY	45.0	Lepomis sp.		Avg. CPUE	50.5	
	Avg. CPUE	22.5		Stratum 5 Site 1	Adult	1.0	Logperch
Stratum 5 Site 1	Adult	18.0	Pumpkinseed		Avg. CPUE	0.5	
	Avg. CPUE	9.0		Stratum 5 Site 1	YOY	4.0	Pumpkinseed
Stratum 5 Site 1	YOY	15.0	Smallmouth bass		Avg. CPUE	2.0	
	Avg. CPUE	7.5		Stratum 5 Site 1	Adult	1.0	Rock bass
Stratum 5 Site 2	YOY	2.0	Banded killifish		Avg. CPUE	0.5	
	Avg. CPUE	1.0		Stratum 5 Site 1	YOY	8.0	Smallmouth bass
Stratum 5 Site 2	YOY	24.0	Brook silverside		Avg. CPUE	4.0	
	Avg. CPUE	12.0		Stratum 5 Site 2	YOY	2.0	Banded killifish
Stratum 5 Site 2	Adult	5.0	Banded killifish		Avg. CPUE	1.0	
	Avg. CPUE	2.5		Stratum 5 Site 2	Adult	1.0	Brook stickleback
Stratum 5 Site 2	YOY	1.0	Largemouth bass		Avg. CPUE	0.5	
	Avg. CPUE	0.5		Stratum 5 Site 2	YOY	4.0	Largemouth bass
Stratum 5 Site 2	YOY	7.0	Lepomis sp.		Avg. CPUE	2.0	
	Avg. CPUE	3.5		Stratum 5 Site 2	YOY	149.0	Lepomis sp.
Stratum 5 Site 2	Adult	2.0	Pumpkinseed		Avg. CPUE	74.5	
	Avg. CPUE	1.0		Stratum 5 Site 2	YOY	3.0	Pumpkinseed
Stratum 5 Site 2	YOY	23.0	Smallmouth bass		Avg. CPUE	1.5	
	Avg. CPUE	11.5		Stratum 5 Site 2	YOY	9.0	Smallmouth bass
Stratum 5 Site 3	YOY	8.0	Largemouth bass		Avg. CPUE	4.5	
	Avg. CPUE	4.0		Stratum 5 Site 3	YOY	17.0	Banded killifish
Stratum 5 Site 3	YOY	100.0	Lepomis sp.		Avg. CPUE	8.5	
	Avg. CPUE	50.0			Adult	41.0	Banded killifish
Stratum 5 Site 3	YOY	20.0	Smallmouth bass		Avg. CPUE	20.5	
	Avg. CPUE	10.0			*Comb. Avg.*	29.0	
Stratum 5 Site 3	YOY	1.0	Yellow perch	Stratum 5 Site 3	YOY	1.0	Brown bullhead
	Avg. CPUE	0.5			Avg. CPUE	0.5	
	Lake CPUE	211.9		Stratum 5 Site 3	YOY	1.0	Common carp
					Avg. CPUE	0.5	
				Stratum 5 Site 3	YOY	1.0	Golden shiner
					Avg. CPUE	0.5	
				Stratum 5 Site 3	YOY	1.0	Largemouth bass
					Avg. CPUE	0.5	
				Stratum 5 Site 3	YOY	132.0	Lepomis sp.
					Avg. CPUE	66.0	
				Stratum 5 Site 3	YOY	1.0	Smallmouth bass
					Avg. CPUE	0.5	
				Stratum 5 Site 3	YOY	2.0	White perch
					Avg. CPUE	1.0	
				Stratum 5 Site 3	YOY	3.0	Yellow perch
					Avg. CPUE	1.5	
					Lake CPUE	69.4	

Appendix Table 10. Continued.

Location	Life Stage	Number of Fish	Species name
Stratum 2 Site 1	YOY	6.0	Lepomis sp.
	Avg. CPUE	3.0	
Stratum 2 Site 2	YOY	2.0	Banded killifish
	Avg. CPUE	1.0	
	Adult	21.0	Banded killifish
	Avg. CPUE	10.5	
	Comb. Avg.	11.5	
Stratum 2 Site 2	Adult	1.0	Brook silverside
	Avg. CPUE	0.5	
Stratum 2 Site 2	YOY	4.0	Largemouth bass
	Avg. CPUE	2.0	
Stratum 2 Site 2	YOY	15.0	Lepomis sp.
	Avg. CPUE	7.5	
Stratum 2 Site 2	YOY	3.0	Smallmouth bass
	Avg. CPUE	1.5	
Stratum 2 Site 3	Adult	33.0	Banded killifish
	Avg. CPUE	16.5	
Stratum 2 Site 3	YOY	5.0	Largemouth bass
	Avg. CPUE	2.5	
Stratum 2 Site 3	YOY	23.0	Lepomis sp.
	Avg. CPUE	11.5	
Stratum 2 Site 3	YOY	9.0	Smallmouth bass
	Avg. CPUE	4.5	
Stratum 3 Site 1	YOY	1.0	Bluntnose minnow
	Avg. CPUE	0.5	
	Adult	1.0	Bluntnose minnow
	Avg. CPUE	0.5	
	Comb. Avg.	1.0	
Stratum 3 Site 1	Adult	33.0	Emerald shiner
	Avg. CPUE	16.5	
Stratum 3 Site 1	YOY	1053.0	Gizzard shad
	Avg. CPUE	526.5	
Stratum 3 Site 1	YOY	8.0	Golden shiner
	Avg. CPUE	4.0	
Stratum 3 Site 1	YOY	1.0	Largemouth bass
	Avg. CPUE	0.5	
Stratum 3 Site 1	YOY	198.0	Lepomis sp.
	Avg. CPUE	99.0	
Stratum 3 Site 1	Adult	12.0	Logperch
	Avg. CPUE	6.0	
Stratum 3 Site 1	YOY	2.0	Pumpkinseed
	Avg. CPUE	1.0	
Stratum 3 Site 1	YOY	22.0	White perch
	Avg. CPUE	11.0	
Stratum 3 Site 1	YOY	197.0	Yellow perch
	Avg. CPUE	98.5	
Stratum 3 Site 2	Adult	9.0	Banded killifish
	Avg. CPUE	4.5	
Stratum 3 Site 2	Adult	1.0	Bluntnose minnow
	Avg. CPUE	0.5	
Stratum 3 Site 2	Adult	2.0	Brook silverside
	Avg. CPUE	1.0	
Stratum 3 Site 2	YOY	3.0	Gizzard shad
	Avg. CPUE	1.5	
Stratum 3 Site 2	YOY	23.0	Largemouth bass
	Avg. CPUE	11.5	
Stratum 3 Site 2	YOY	412.0	Lepomis sp.
	Avg. CPUE	206.0	

Location	Life Stage	Number of Fish	Species name
Stratum 1 Site 3	YOY	6.0	Tessellated darter
	Avg. CPUE	3.0	
	Adult	1.0	Tessellated darter
	Avg. CPUE	0.5	
	Comb. Avg.	3.5	
Stratum 1 Site 3	YOY	2.0	Yellow perch
	Avg. CPUE	1.0	
Stratum 2 Site 1	Adult	31.0	Banded killifish
	Avg. CPUE	15.5	
Stratum 2 Site 2	YOY	4.0	Banded killifish
	Avg. CPUE	2.0	
	Adult	46.0	Banded killifish
	Avg. CPUE	23.0	
	Comb. Avg.	25.0	
Stratum 2 Site 2	Adult	1.0	Golden shiner
	Avg. CPUE	0.5	
Stratum 2 Site 2	YOY	6.0	Lepomis sp.
	Avg. CPUE	3.0	
Stratum 2 Site 2	YOY	1.0	Yellow perch
	Avg. CPUE	0.5	
Stratum 2 Site 3	Adult	118.0	Banded killifish
	Avg. CPUE	59.0	
Stratum 2 Site 3	YOY	4.0	Gizzard shad
	Avg. CPUE	2.0	
Stratum 2 Site 3	Adult	1.0	Golden shiner
	Avg. CPUE	0.5	
Stratum 2 Site 3	YOY	6.0	Lepomis sp.
	Avg. CPUE	3.0	
Stratum 2 Site 3	YOY	1.0	Smallmouth bass
	Avg. CPUE	0.5	
Stratum 2 Site 3	Adult	1.0	White perch
	Avg. CPUE	0.5	
Stratum 2 Site 3	YOY	2.0	Yellow perch
	Avg. CPUE	1.0	
Stratum 3 Site 1	Adult	43.0	Banded killifish
	Avg. CPUE	21.5	
Stratum 3 Site 1	Adult	1.0	Bluntnose minnow
	Avg. CPUE	0.5	
Stratum 3 Site 1	Adult	3.0	Brook silverside
	Avg. CPUE	1.5	
Stratum 3 Site 1	YOY	1.0	Golden shiner
	Avg. CPUE	0.5	
Stratum 3 Site 1	YOY	5.0	Largemouth bass
	Avg. CPUE	2.5	
Stratum 3 Site 1	YOY	91.0	Lepomis sp.
	Avg. CPUE	45.5	
Stratum 3 Site 1	YOY	1.0	Longnose dace
	Avg. CPUE	0.5	
Stratum 3 Site 2	Adult	8.0	Banded killifish
	Avg. CPUE	4.0	
Stratum 3 Site 2	YOY	15.0	Bluegill
	Avg. CPUE	7.5	
Stratum 3 Site 2	YOY	3.0	Golden shiner
	Avg. CPUE	1.5	
Stratum 3 Site 2	YOY	2.0	Largemouth bass
	Avg. CPUE	1.0	

Appendix Table 10. Continued.

August juvenile seining			
Location	Life Stage	Number of fish	Species name
Stratum 3 Site 2	Adult	5.0	Logperch
	Avg. CPUE	2.5	
Stratum 3 Site 2	YOY	1.0	Pumpkinseed
	Avg. CPUE	0.5	
Stratum 3 Site 2	YOY	47.0	Smallmouth bass
	Avg. CPUE	23.5	
Stratum 3 Site 2	YOY	2.0	White sucker
	Avg. CPUE	1.0	
Stratum 3 Site 2	YOY	3.0	White perch
	Avg. CPUE	1.5	
Stratum 3 Site 2	YOY	38.0	Yellow perch
	Avg. CPUE	19.0	
Stratum 3 Site 3	Adult	27.0	Banded killifish
	Avg. CPUE	13.5	
Stratum 3 Site 3	YOY	1.0	Bluntnose minnow
	Avg. CPUE	0.5	
	Adult	1.0	Bluntnose minnow
	Avg. CPUE	0.5	
	Comb. Avg.	1.0	
Stratum 3 Site 3	YOY	39.0	Largemouth bass
	Avg. CPUE	19.5	
Stratum 3 Site 3	YOY	1009.0	Lepomis sp.
	Avg. CPUE	504.5	
Stratum 3 Site 3	YOY	2.0	Smallmouth bass
	Avg. CPUE	1.0	
Stratum 3 Site 3	YOY	1.0	White sucker
	Avg. CPUE	0.5	
Stratum 3 Site 3	YOY	8.0	Yellow perch
	Avg. CPUE	4.0	
Stratum 4 Site 1	YOY	1.0	Banded killifish
	Avg. CPUE	0.5	
	Adult	24.0	Banded killifish
	Avg. CPUE	12.0	
	Comb. Avg.	12.5	
Stratum 4 Site 1	Adult	1.0	Bluntnose minnow
	Avg. CPUE	0.5	
Stratum 4 Site 1	YOY	1.0	Gizzard shad
	Avg. CPUE	0.5	
Stratum 4 Site 1	Adult	1.0	Golden shiner
	Avg. CPUE	0.5	
Stratum 4 Site 1	YOY	23.0	Largemouth bass
	Avg. CPUE	11.5	
Stratum 4 Site 1	YOY	1100.0	Lepomis sp.
	Avg. CPUE	550.0	
Stratum 4 Site 1	YOY	2.0	Logperch
	Avg. CPUE	1.0	
	Adult	8.0	Logperch
	Avg. CPUE	4.0	
	Comb. Avg.	6.0	
Stratum 4 Site 1	YOY	39.0	Smallmouth bass
	Avg. CPUE	19.5	
Stratum 4 Site 1	YOY	1.0	White sucker
	Avg. CPUE	0.5	
Stratum 4 Site 1	YOY	9.0	White perch
	Avg. CPUE	4.5	
Stratum 4 Site 1	YOY	36.0	Yellow perch
	Avg. CPUE	18.0	
Stratum 4 Site 2	YOY	10.0	Largemouth bass
	Avg. CPUE	5.0	
Stratum 4 Site 2	YOY	2.0	Smallmouth bass
	Avg. CPUE	1.0	

September juvenile seining			
Location	Life Stage	Number of fish	Species name
Stratum 3 Site 2	YOY	17.0	Lepomis sp.
	Avg. CPUE	8.5	
Stratum 3 Site 2	YOY	18.0	Pumpkinseed
	Avg. CPUE	9.0	
Stratum 3 Site 2	YOY	4.0	Smallmouth bass
	Avg. CPUE	2.0	
Stratum 3 Site 2	YOY	18.0	Yellow perch
	Avg. CPUE	9.0	
Stratum 3 Site 3	Adult	8.0	Banded killifish
	Avg. CPUE	4.0	
Stratum 3 Site 3	YOY	3.0	Largemouth bass
	Avg. CPUE	1.5	
Stratum 3 Site 3	YOY	18.0	Lepomis sp.
	Avg. CPUE	9.0	
Stratum 4 Site 1	Adult	20.0	Banded killifish
	Avg. CPUE	10.0	
Stratum 4 Site 1	Adult	5.0	Brook silverside
	Avg. CPUE	4.0	
Stratum 4 Site 1	YOY	1.0	Largemouth bass
	Avg. CPUE	0.5	
Stratum 4 Site 1	YOY	29.0	Lepomis sp.
	Avg. CPUE	14.5	
Stratum 4 Site 1	YOY	1.0	Smallmouth bass
	Avg. CPUE	0.5	
Stratum 4 Site 1	Adult	1.0	Tessellated darter
	Avg. CPUE	0.5	
Stratum 4 Site 2	Adult	1.0	Banded killifish
	Avg. CPUE	0.5	
Stratum 4 Site 2	Adult	1.0	Emerald shiner
	Avg. CPUE	0.5	
Stratum 4 Site 2	Adult	2.0	Golden shiner
	Avg. CPUE	1.0	
Stratum 4 Site 2	YOY	3.0	Largemouth bass
	Avg. CPUE	1.5	
Stratum 4 Site 2	YOY	107.0	Lepomis sp.
	Avg. CPUE	53.5	
Stratum 4 Site 2	YOY	4.0	Pumpkinseed
	Avg. CPUE	2.0	
Stratum 4 Site 2	YOY	1.0	Smallmouth bass
	Avg. CPUE	0.5	
Stratum 4 Site 3	YOY	37.0	Banded killifish
	Avg. CPUE	18.5	
Stratum 4 Site 3	YOY	2.0	Bluegill
	Avg. CPUE	1.0	
Stratum 4 Site 3	YOY	1.0	Bluntnose minnow
	Avg. CPUE	0.5	
Stratum 4 Site 3	YOY	1.0	Gizzard shad
	Avg. CPUE	0.5	
Stratum 4 Site 3	YOY	11.0	Golden shiner
	Avg. CPUE	5.5	
Stratum 4 Site 3	YOY	3.0	Largemouth bass
	Avg. CPUE	1.5	

Appendix Table 11. Electrofishing catch-per-hour from the May 2001 Onondaga Lake AMP by species, transect, and type of run (all fish or * gamefish only).

May-01 Transect	Species	Number of fish	CPUE
1	Bluegill	20	85.71
1	Brown bullhead	1	4.29
1	Carp	28	120.00
1	Gizzard shad	5	21.43
1	Largemouth bass	7	30.00
1	Pumpkinseed	16	68.57
1	Shorthead redhorse	4	17.14
1	Smallmouth bass	12	51.43
1	White perch	19	81.43
1	White sucker	7	30.00
1	Yellow perch	9	38.57
2 *	Bluegill	15	71.15
2 *	Brown bullhead	2	9.49
2 *	Largemouth bass	1	4.74
2 *	Pumpkinseed	15	71.15
2 *	Smallmouth bass	10	47.43
2 *	Yellow perch	1	4.74
3	Bluegill	23	107.39
3	Carp	2	9.34
3	Gizzard shad	3	14.01
3	Largemouth bass	2	9.34
3	Pumpkinseed	20	93.39
3	Shorthead redhorse	3	14.01
3	Smallmouth bass	9	42.02
3	White perch	11	51.36
3	White sucker	19	88.72
3	Yellow perch	10	46.69
4 *	Bluegill	34	146.06
4 *	Brown bullhead	9	38.66
4 *	Largemouth bass	1	4.30
4 *	Pumpkinseed	18	77.33
4 *	Smallmouth bass	24	103.10
4 *	Walleye	1	4.30
4 *	Yellow perch	7	30.07
5	Alewife	2	8.09
5	Bluegill	26	105.17
5	Brown bullhead	3	12.13
5	Carp	59	238.65
5	Channel catfish	1	4.04
5	Largemouth bass	3	12.13
5	Longnose gar	1	4.04
5	Pumpkinseed	14	56.63
5	Smallmouth bass	11	44.49

Appendix Table 11. Continued.

May-01 Transect	Species	Number of fish	CPUE
5	Walleye	2	8.09
5	White perch	5	20.22
5	White sucker	1	4.04
5	Yellow perch	9	36.40
6 *	Bluegill	15	67.25
6 *	Largemouth bass	8	35.87
6 *	Pumpkinseed	3	13.45
6 *	Smallmouth bass	12	53.80
6 *	Yellow perch	5	22.42
7	Bluegill	13	62.90
7	Brown bullhead	1	4.84
7	Carp	5	24.19
7	Gizzard shad	3	14.52
7	Largemouth bass	13	62.90
7	Pumpkinseed	7	33.87
7	Smallmouth bass	16	77.42
7	White perch	3	14.52
7	Yellow perch	4	19.35
8 *	Bluegill	1	5.00
8 *	Largemouth bass	3	15.00
8 *	Pumpkinseed	5	25.00
8 *	Smallmouth bass	6	30.00
8 *	Yellow perch	5	25.00
9	Bluegill	3	17.01
9	Brown bullhead	2	11.34
9	Carp	6	34.02
9	Gizzard shad	1	5.67
9	Largemouth bass	2	11.34
9	Pumpkinseed	8	45.35
9	Smallmouth bass	3	17.01
9	Tiger muskellunge	1	5.67
9	White perch	2	11.34
9	White sucker	10	56.69
9	Yellow perch	23	130.39
10 *	Largemouth bass	3	15.43
10 *	Pumpkinseed	8	41.14
10 *	Smallmouth bass	4	20.57
10 *	Yellow perch	8	41.14
11	Bluegill	2	7.36
11	Brown bullhead	1	3.68
11	Carp	16	58.90
11	Gizzard shad	17	62.58
11	Pumpkinseed	3	11.04
11	Shorthead redhorse	1	3.68
11	Smallmouth bass	4	14.72

Appendix Table 11. Continued.

May-01 Transect	Species	Number of fish	CPUE
11	Walleye	3	11.04
11	White perch	8	29.45
11	White sucker	22	80.98
11	Yellow perch	14	51.53
12 *	Pumpkinseed	2	10.14
12 *	Smallmouth bass	1	5.07
12 *	Yellow perch	6	30.42
13	Alewife	1	4.88
13	Brown bullhead	2	9.76
13	Carp	18	87.80
13	Gizzard shad	13	63.41
13	Pumpkinseed	2	9.76
13	Shorthead redhorse	3	14.63
13	Smallmouth bass	1	4.88
13	White perch	11	53.66
13	White sucker	23	112.20
13	Yellow perch	3	14.63
14 *	Bluegill	5	23.14
14 *	Largemouth bass	3	13.88
14 *	Pumpkinseed	5	23.14
14 *	Smallmouth bass	1	4.63
14 *	Yellow perch	7	32.39
15	Alewife	2	9.38
15	Bluegill	3	14.06
15	Brown bullhead	2	9.38
15	Carp	36	168.75
15	Freshwater drum	3	14.06
15	Gizzard shad	44	206.25
15	Pumpkinseed	4	18.75
15	White perch	7	32.81
15	White sucker	9	42.19
15	Yellow perch	8	36.73
16 *	Yellow perch	2	9.18
17	Bluegill	1	6.06
17	Carp	5	30.30
17	Channel catfish	1	6.06
17	Gizzard shad	18	109.09
17	Pumpkinseed	2	12.12
17	White perch	2	12.12
17	White sucker	3	18.18
17	Yellow perch	7	42.42
18 *	Pumpkinseed	1	4.77
18 *	Smallmouth bass	1	4.77
18 *	Walleye	1	4.77
18 *	Yellow perch	12	57.22

Appendix Table 11. Continued.

May-01 Transect	Species	Number of fish	CPUE
19	Bluegill	3	13.45
19	Carp	10	44.83
19	Channel catfish	3	13.45
19	Freshwater drum	1	4.48
19	Gizzard shad	25	112.08
19	Largemouth bass	2	8.97
19	Pumpkinseed	9	40.35
19	Smallmouth bass	1	4.48
19	White perch	3	13.45
19	White sucker	4	17.93
19	Yellow perch	9	40.35
20 *	Bluegill	11	51.83
20 *	Pumpkinseed	8	37.70
20 *	Smallmouth bass	1	4.71
20 *	Yellow perch	6	28.27
21	Bluegill	18	84.38
21	Carp	36	168.75
21	Gizzard shad	234	1096.88
21	Pumpkinseed	10	46.88
21	Walleye	2	9.38
21	White perch	48	225.00
21	White sucker	3	14.06
21	Yellow perch	3	14.06
22 *	Bluegill	20	100.56
22 *	Brown bullhead	2	10.06
22 *	Pumpkinseed	9	45.25
22 *	Smallmouth bass	1	5.03
22 *	Walleye	1	5.03
22 *	Yellow perch	2	10.06
23	Bluegill	11	56.98
23	Carp	22	113.96
23	Gizzard shad	3	15.54
23	Northern pike	1	5.18
23	Pumpkinseed	21	108.78
23	Shorthead redhorse	8	41.44
23	Smallmouth bass	3	15.54
23	Walleye	1	5.18
23	White perch	6	31.08
23	White sucker	8	41.44
23	Yellow perch	4	20.72
24 *	Bluegill	5	25.28
24 *	Pumpkinseed	19	96.07
24 *	Smallmouth bass	3	15.17
24 *	Yellow perch	2	10.11

Appendix Table 12. Electrofishing catch-per-hour from the September 2001 Onondaga Lake AMP by species, transect, and type of run (all fish or * gamefish only).

September-01 Transect	Species	Number of fish	CPUE
1	Bluegill	5	24.13
1	Brown bullhead	2	9.65
1	Carp	17	82.04
1	Gizzard shad	4	19.30
1	Largemouth bass	1	4.83
1	Pumpkinseed	3	14.48
1	Smallmouth bass	1	4.83
1	White perch	3	14.48
1	White sucker	2	9.65
1	Yellow perch	3	14.48
2 *	Bluegill	4	21.05
2 *	Largemouth bass	2	10.53
2 *	Northern pike	1	5.26
2 *	Smallmouth bass	2	10.53
2 *	Walleye	1	5.26
2 *	Yellow perch	1	5.26
3	Bluegill	4	20.78
3	Carp	5	25.97
3	Channel catfish	1	5.19
3	Gizzard shad	8	41.56
3	Shorthead redhorse	5	25.97
3	Smallmouth bass	6	31.17
3	White perch	18	93.51
3	White sucker	2	10.39
3	Yellow perch	2	10.39
4 *	Bluegill	17	87.43
4 *	Largemouth bass	3	15.43
4 *	Pumpkinseed	4	20.57
4 *	White perch	1	5.14
4 *	Yellow perch	2	10.29
5	Bluegill	11	45.00
5	Bowfin	1	4.09
5	Carp	9	36.82
5	Freshwater drum	2	8.18
5	Gizzard shad	20	81.82
5	Largemouth bass	8	32.73
5	Pumpkinseed	2	8.18
5	Smallmouth bass	1	4.09
5	Walleye	1	4.09
5	White perch	1	4.09
5	White sucker	1	4.09
5	Yellow perch	1	4.09
6 *	Bluegill	1	5.08

Appendix Table 12. Continued.

September 01 Transect	Species	Number of fish	CPUE
6 *	Largemouth bass	1	5.08
6 *	Smallmouth bass	1	5.08
6 *	Yellow perch	1	5.08
7	Carp	5	25.10
7	Gizzard shad	10	50.21
7	Largemouth bass	1	5.02
7	Smallmouth bass	1	5.02
7	White sucker	3	15.06
7	Yellow perch	4	20.08
8 *	Largemouth bass	1	6.05
8 *	Pumpkinseed	1	6.05
9	Freshwater drum	1	5.28
9	Gizzard shad	6	31.67
9	Largemouth bass	2	10.56
9	Smallmouth bass	7	36.95
9	White sucker	2	10.56
9	Yellow perch	2	10.56
10 *	Longnose gar	1	5.83
11	Brown bullhead	1	5.90
11	Carp	8	47.21
11	Gizzard shad	4	23.61
11	Pumpkinseed	1	5.90
11	White sucker	1	5.90
12 *	Pumpkinseed	1	4.76
12 *	Smallmouth bass	1	4.76
12 *	Walleye	1	4.76
12 *	Yellow perch	2	9.52
13	Bluegill	1	5.26
13	Carp	5	26.32
13	Freshwater drum	1	5.26
13	Gizzard shad	3	15.79
13	Shorthead redhorse	2	10.53
13	White perch	2	10.53
13	White sucker	10	52.63
13	Yellow perch	9	47.37
14 *	Brown bullhead	1	5.39
14 *	Channel catfish	1	5.39
14 *	Largemouth bass	1	5.39
14 *	Pumpkinseed	1	5.39
14 *	Smallmouth bass	4	21.56
14 *	Yellow perch	3	16.17
15	Carp	7	31.19
15	Gizzard shad	2	8.91
15	Largemouth bass	1	4.46
15	Pumpkinseed	4	17.82

Appendix Table 12. Continued.

September-01 Transect	Species	Number of fish	CPUE
15	Smallmouth bass	1	4.46
15	White perch	5	22.28
15	White sucker	7	31.19
15	Yellow perch	5	22.28
16 *	Longnose gar	3	14.69
16 *	Smallmouth bass	1	4.90
17	Brown bullhead	1	5.59
17	Carp	10	55.90
17	Channel catfish	1	5.59
17	Freshwater drum	2	11.18
17	Gizzard shad	5	27.95
17	Largemouth bass	1	5.59
17	Shorthead redhorse	1	5.59
17	White perch	12	67.08
17	White sucker	6	33.54
17	Yellow perch	3	16.77
18 *	Channel catfish	1	5.08
18 *	Largemouth bass	3	15.25
18 *	Longnose gar	1	5.08
19	Carp	2	9.89
19	Gizzard shad	2	9.89
19	Smallmouth bass	3	14.84
19	White perch	7	34.62
19	White sucker	4	19.78
19	Yellow perch	3	14.84
20 *	Channel catfish	1	5.37
20 *	Largemouth bass	1	5.37
20 *	Smallmouth bass	3	16.12
21	Carp	6	31.86
21	Freshwater drum	1	5.31
21	Pumpkinseed	1	5.31
21	Shorthead redhorse	1	5.31
21	Smallmouth bass	1	5.31
21	Walleye	2	10.62
21	White perch	8	42.48
21	White sucker	3	15.93
21	Yellow perch	1	5.31
22 *	Channel catfish	2	10.24
22 *	Yellow perch	7	35.85
23	Bluegill	1	4.88
23	Carp	7	34.15
23	Channel catfish	1	4.88
23	Freshwater drum	2	9.76
23	Gizzard shad	2	9.76
23	Largemouth bass	1	4.88

Appendix Table 12. Continued.

September 03 Transect	Species	Number of fish	CPUE
23	Pumpkinseed	1	4.88
23	Shorthead redhorse	1	4.88
23	Smallmouth bass	1	4.88
23	White perch	15	73.17
23	White sucker	3	14.63
24 *	Bluegill	3	15.72
24 *	Largemouth bass	2	10.48
24 *	Pumpkinseed	1	5.24

Appendix Table 13. Electrofishing catch-per-hour from the October 2001 Onondaga Lake AMP by species, transect, and type of run (all fish or * gamefish only).

October-01 Transect	Species	Number of fish	CPUE
1	Bluegill	4	21.65
1	Carp	25	135.34
1	Channel catfish	1	5.41
1	Largemouth bass	2	10.83
1	Shorthead redhorse	2	10.83
1	Smallmouth bass	1	5.41
1	White sucker	4	21.65
1	Yellow perch	4	21.65
2 *	Bluegill	2	11.15
2 *	Channel catfish	1	5.57
2 *	Smallmouth bass	1	5.57
2 *	Yellow perch	3	16.72
3	Carp	4	22.43
3	Channel catfish	1	5.61
3	Gizzard shad	1	5.61
3	Logperch	2	11.21
3	White perch	14	78.50
3	White sucker	1	5.61
3	Yellow perch	3	16.82
4 *	Black crappie	1	5.48
4 *	Bluegill	18	98.63
4 *	Pumpkinseed	1	5.48
4 *	Rock bass	2	10.96
4 *	Smallmouth bass	1	5.48
4 *	Yellow perch	1	5.48
5	Black crappie	1	4.12
5	Bluegill	14	57.73
5	Brown bullhead	3	12.37
5	Carp	86	354.64
5	Channel catfish	1	4.12
5	Gizzard shad	4	16.49
5	Largemouth bass	12	49.48
5	Pumpkinseed	1	4.12
5	Rock bass	4	16.49
5	Smallmouth bass	1	4.12
5	White perch	15	61.86
5	White sucker	1	4.12
5	Yellow perch	4	16.49
6 *	Black crappie	1	4.59
6 *	Bluegill	10	45.86
6 *	Brown bullhead	3	13.76
6 *	Largemouth bass	4	18.34
6 *	Rock bass	1	4.59

Appendix Table 13. Continued.

October-01 Transect	Species	Number of fish	CPUE
6 *	Walleye	1	4.59
6 *	Yellow perch	1	4.59
7	Channel catfish	1	4.43
7	Largemouth bass	3	13.28
7	Smallmouth bass	1	4.43
7	White perch	15	66.42
7	White sucker	1	4.43
7	Yellow perch	2	8.86
7	Brown bullhead	1	4.43
7	Carp	18	79.70
8 *	Smallmouth bass	1	5.65
8 *	Yellow perch	3	16.95
9	Carp	7	38.89
9	Gizzard shad	1	5.56
9	Walleye	1	5.56
9	White perch	30	166.67
9	White sucker	4	22.22
9	Yellow perch	5	27.78
10 *	Channel catfish	1	5.68
10 *	Yellow perch	1	5.68
11	Carp	3	16.27
11	Freshwater drum	1	5.42
11	Shorthead redhorse	1	5.42
12 *	Smallmouth bass	3	14.21
12 *	Yellow perch	4	18.95
13	Carp	7	36.21
13	Largemouth bass	1	5.17
13	Smallmouth bass	3	15.52
13	White perch	2	10.34
13	White sucker	6	31.03
13	Yellow perch	9	46.55
14 *	Largemouth bass	1	4.66
14 *	Yellow perch	1	4.66
15	Yellow perch	2	11.76
15	Carp	9	52.94
15	Smallmouth bass	1	5.88
15	White sucker	3	17.65
16 *	Smallmouth bass	1	5.14
17	Brown bullhead	1	6.19
17	Carp	11	68.04
17	Channel catfish	1	6.19
17	Gizzard shad	2	12.37
17	Walleye	1	6.19
17	White sucker	5	30.93
17	Yellow perch	2	12.37

Appendix Table 13. Continued.

October-01 Transect	Species	Number of fish	CPUE
18 *	Channel catfish	1	5.20
18 *	Walleye	1	5.20
19	Brown bullhead	1	5.60
19	Carp	33	184.76
19	Gizzard shad	8	44.79
19	White perch	2	11.20
19	White sucker	3	16.80
19	Yellow perch	15	83.98
20 *	Longnose gar	1	5.29
20 *	Yellow perch	25	132.16
21	Carp	15	83.33
21	Freshwater drum	1	5.56
21	White perch	9	50.00
21	Yellow perch	14	77.78
22 *	Brown bullhead	2	10.68
22 *	Yellow perch	26	138.87
23	Carp	16	87.54
23	Shorthead redhorse	1	5.47
23	White perch	2	10.94
23	White sucker	1	5.47
23	Yellow perch	5	27.36
24 *	Bluegill	3	17.39
24 *	Pumpkinseed	1	5.80
24 *	Smallmouth bass	1	5.80
24 *	Yellow perch	1	5.80